

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

Application Number: 10/576,438

Examiner: Marc A. Patterson, Ph.D.

Applicant: Dan G. Siegel, et al.

Art Unit: 1782

371(c) Date: April 9, 2007

Filing Date: April 20, 2006

Title: Packaging Method That Causes and Maintains the Preferred Red Color of Fresh Meat

Docket Number: 20737-PCT-US

Customer Number: 30482

Certificate of Submission

I hereby certify that this correspondence is being submitted to the United States Patent and Trademark Office via EFS-Web on June 23, 2011 by Christine E. Parsons.

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APPEAL BRIEF

Applicant files this brief in support of an appeal to the Board of Patent Appeals and Interferences ("the Board") from the Examiner's Office Action of June 24, 2010. The June 24, 2010 Office Action is a final action, the Examiner having twice rejected each of the pending claims (i.e., claims 1, 3-5, 7-18, 20, 22-24 and 26-27). In the July 22, 2009 Office Action, the Examiner rejected claims 1-4, 6-11, 16, 19-24 and 26 under 35 U.S.C. § 102(b) as allegedly being anticipated by U.S. Patent 6,623,773 ("Meier et al.") as evidenced by U.S. Patent 4,781,934 ("Shimp et al."), rejected claims 5 and 27 under 35 U.S.C. § 103(a) as allegedly being unpatentable over Meier et al., and rejected claims 12-15 and 17-18 under 35 U.S.C. § 103(a) as allegedly being

unpatentable over Meier et al. in view of U.S. Patent 2,621,129 ("Ramsbottom et al."). Following applicant's January 22, 2010 reply, in the June 24, 2010 Office Action the Examiner withdrew these rejections and then rejected claims 1, 3-5, 7-17, 20, 22-24 and 26-27 under 35 U.S.C. § 103(a) as allegedly being unpatentable over U.S. Patent Application Publication 2002/0172834 ("Rivett et al.") in view of US Patent 4,476,112 ("Aversano") and rejected claim 18 under 35 U.S.C. § 103(a) as allegedly being unpatentable over Rivett et al. in view of Aversano and further in view of Ramsbottom et al. The applicant filed a Notice of Appeal on November 24, 2010.

Please charge deposit account number 502023 in the amount of \$540.00 for the fee for filing a brief in support of the Notice of Appeal. Any deficiency or overpayment should be charged or credited to this same deposit account number 502023. A Petition for Extension of Time under 37 CFR § 1.136(a) is submitted with this appeal brief. As requested in the Petition, please also charge deposit account number 502023 in the amount of \$2,350.00 for the cost of the extension of time from January 24, 2011 to June 23, 2011. Once again, any deficiency or overpayment should be charged or credited to deposit account number 502023.

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Real Party in Interest

The real party in interest is Curwood, Inc., the recorded assignee of the entire right, title and interest in and to the application related to this pending appeal. Curwood is a wholly-owned subsidiary of Bemis Company, Inc.

Related Appeals and Interferences

All prior and pending appeals, judicial proceedings or interferences known to the appellants, the appellants' legal representative and the assignee which may be related to, directly affect, be directly affected by or have a bearing on the Board's decision in this appeal are as follows:

Application No. 11/413,504:	Notice of Appeal filed February 2, 2010 Appeal Brief filed February 2, 2010 Notice of Allowance mailed May 13, 2010 Patent issued January 11, 2011
Application No. 11/436,159:	Notice of Appeal filed August 10, 2010 Appeal Brief filed January 21, 2011 Non-Final Rejection mailed April 12, 2011 Notice of Appeal filed May 5, 2011
Application No. 11/451,968:	Notice of Appeal filed January 5, 2011 Appeal Brief filed May 5, 2011
Application No. 11/506,322:	Notice of Appeal filed November 24, 2010 Appeal Brief filed March 23, 2011 Examiner's Answer mailed June 9, 2011
Application No. 11/532,953:	Notice of Appeal filed May 10, 2010 Appeal Brief filed May 10, 2010 Examiner's Answer mailed August 19, 2010 Reply Brief filed September 15, 2010 Reply Brief Notation mailed November 24, 2010 Appeal Docketing Notice mailed December 3, 2010 Assigned Appeal No: 2011-002657
Application No. 11/584,164:	Notice of Appeal filed February 12, 2010 Appeal Brief filed September 13, 2010 Non-Final Rejection mailed November 24, 2010 Notice of Appeal filed May 23, 2011 Pre-Brief Conference Request mailed May 23, 2011

Each of the above applications is a continuing application of this application (i.e., the application related to this appeal), and this application is a priority application to each of the above applications.

The Board has not rendered any decision in any of the above appeals; therefore, appellants have included a Related Proceedings Appendix with the indication "None."

Status of Claims

Each of claims 1, 3-5, 7-18, 20, 22-24 and 26-27 is pending. The status of each of claims 1, 3-5, 7-18, 20, 22-24 and 26-27 is "rejected" per the June 24, 2010 Office Action. Claims 1, 3-5, 7-18, 20, 22-24 and 26-27 are the claims on appeal. Appellants have included a Claims Appendix containing a complete copy of the pending claims.

Status of Amendments

Appellants have filed no amendments subsequent to the rejection of each of claims 1, 3-5, 7-18, 20, 22-24 and 26-27 in the June 24, 2010 Office Action.

Summary of the Claimed Subject Matter

Claim 1 and its dependent claims (claims 3-5 and 7-12) are to a food packaging film. The food packaging film is used in creating and stabilizing a desirable color on a viewable surface of a raw myoglobin-containing food product. (See, e.g., Page 9 lines 22-29 of the application as filed.) The food packaging film creates and stabilizes the color without deleteriously affecting the subsurface color of the food product. (See, e.g., Page 10 lines 16-18 and Page 10 lines 27-29 of the application as filed.) The food packaging film comprises a food contact layer capable of contacting the food product held within a package formed with the film. (See, e.g., Page 13 lines 7-8 and Figures 1 and 3 of the application as filed.) The food packaging film is a barrier to oxygen. (See, e.g., Page 17 lines 3-5 of the application as filed.) The food packaging film comprises an effective amount of a nitrogen oxide-containing compound capable of interacting with the myoglobin-containing food product to produce the desirable color. (See, e.g., Page 13 lines 12-15 and Page 15 lines 28-32 of the application as filed.) The effective amount of the nitrogen oxide-containing compound is insufficient to effectively cure the entire myoglobin-containing food product. (See, e.g., Page 16 line 9 of the application as filed.)

Claim 13 and its dependent claims (claim 14-15) are to a food packaging container. The food packaging container comprises a tray adapted to hold a food item therein and a film positioned over the tray to maintain the food item therein. (See, e.g., Page 12 lines 25-32 and Figures 1 and 3 of the application as filed.) The film includes an effective amount of a nitrogen oxide-containing compound. (See, e.g., Page 13 lines 12-15 and Page 15 lines 28-32 of the application as filed.) The film is adapted to be in contact with the food item held within the tray. (See, e.g., Page 13 lines 7-8 and Figures 1 and 3 of the application as filed.) The tray is a barrier to oxygen. (See, e.g., Page 17 lines 26-30 of the application as filed.) The film is a barrier to oxygen. (See, e.g., Page 17 lines 3-5 of the application as filed.) The effective amount of the nitrogen oxide-containing compound is capable of creating and stabilizing a desirable color on a viewable surface of the food item. (See, e.g., Page 9 lines 22-29 of the application as filed.) The

effective amount of the nitrogen oxide-containing compound is insufficient to effectively cure the entire food item. (See, e.g., Page 16 line 9 of the application as filed.)

Claim 16 and its dependent claims (claims 17-18, 20 and 22-24) are to a method of packaging a food item. The method creates and stabilizes a desirable color on a viewable surface of the food item. (See, e.g., Page 9 lines 22-29 of the application as filed.) The method comprises a step of providing a film including an oxide of nitrogen. (See, e.g., Page 13 lines 12-15 and Page 15 lines 28-32 of the application as filed.) The method also comprises a step of contacting the film with the food item to form a package for the food item. (See, e.g., Page 13 lines 7-8 and Figures 1 and 3 of the application as filed.) The film is a barrier to oxygen. (See, e.g., Page 17 lines 3-5 of the application as filed.) The oxide of nitrogen is in an amount that is insufficient to effectively cure the entire food item. (See, e.g., Page 16 line 9 of the application as filed.)

Claim 26 is to a method for creating and stabilizing a desirable color in a food product. The method comprises the step of contacting a viewable surface of the food product with an effective amount of a nitrogen oxide-containing compound. (See, e.g., Page 13 lines 12-15 and Page 15 lines 28-32 of the application as filed.) The step of contacting the viewable surface comprises releasing the nitrogen oxide-containing compound into contact with the food product in a controlled manner. (See, e.g., Page 15 line 28 – Page 16 line 5 of the application as filed.) The nitrogen oxide-containing compound is released in an amount insufficient to effectively cure the entire food product. (See, e.g., Page 16 line 9 of the application as filed.). In this method, oxygen is barred from the food product. (See, e.g., Page 14 lines 22-24 and Page 17 lines 3-5 of the application as filed.)

Claim 27 is to a vacuum packaged meat. The vacuum packaged meat comprises an uncooked meat product vacuum packaged in a multilayer polymeric film. (See, e.g., Page 12 lines 22-32, Page 13 lines 3-11 and Figures 1-3 of the application as filed.) The multilayer polymeric film has a first oxygen barrier polymeric layer. (See, e.g., Page 17 lines 3-5 of the application as filed.) The multilayer polymeric film has a second surface layer containing an oxide of nitrogen.

(See, e.g., Page 13 lines 12-15 and Page 15 lines 28-32 of the application as filed.) The oxide of nitrogen is selected from the group consisting of sodium nitrite, sodium nitrate, potassium nitrite, potassium nitrate and blend thereof. (See, e.g., Page 18 lines 21-25 of the application as filed.). The oxide of nitrogen is in an effective amount sufficient to transfer at least 0.0008 milligram per square inch to the uncooked meat product within 96 hours. (See, e.g., Page 19 lines 1-4 of the application as filed.) But, this effective amount is insufficient to effectively cure the entire uncooked meat product. (See, e.g., Page 16 line 9 of the application as filed.)

Grounds of Rejection to be Reviewed on Appeal

1. Whether claims 1, 3-5, 7-17, 20, 22-24 and 26-27 are patentable under 35 U.S.C. § 103(a) over U.S. Patent Application Publication 2002/0172834 ("Rivett et al.") in view of US Patent 4,476,112 ("Aversano").

2. Whether claim 18 is patentable under 35 U.S.C. § 103(a) over U.S. Patent Application Publication 2002/0172834 ("Rivett et al.") in view of US Patent 4,476,112 ("Aversano") and further in view of US Patent 2,621,129 ("Ramsbottom et al.").

Appellants have provided copies of Rivett et al., Aversano and Ramsbottom et al. in the Evidence Appendices.

Arguments

Each of claims 1, 3-5, 7-17, 20, 22-24 and 26-27 is patentable under 35 U.S.C. § 103(a) over Rivett et al. in view of Aversano. And claim 18 is patentable under 35 U.S.C. § 103(a) over Rivett et al. in view of Aversano and further in view of Ramsbottom et al.

Prior to turning to the merits of the June 24, 2010 Office Action, appellants respectfully note that the general, broad issue for the Board to decide in this appeal is whether Rivett et al. in view of Aversano renders the subject matter of any of the rejected claims, particularly independent claims 1, 13, 16, 26 and 27, as a whole obvious within the meaning of 35 U.S.C. § 103(a). As explained in In re Dembiczak, "The ultimate determination of whether an invention is or is not obvious is a legal conclusion based on underlying factual inquiries. . . ." 50 USPQ2d 1614, 1616 (Fed. Cir. 1999). As further explained in In re Oetiker,

[T]he examiner bears the initial burden, on review of the prior art or on any other ground, of presenting a *prima facie* case of unpatentability. If that burden is met, the burden of coming forward with evidence or argument shifts to the applicant. . . . If examination at the initial stage does not produce a *prima facie* case of unpatentability, then without more the applicant is entitled to grant of the patent.

24 USPQ2d 1443, (Fed. Cir. 1992) (citations omitted). That it is incumbent upon the Examiner to provide a reason for his conclusion of obviousness was affirmed by the Court in KSR International Co. v. Teleflex Inc.:

Rejections on obviousness grounds cannot be sustained by mere conclusory statements; instead, there must be some articulated reasoning with some rational underpinning to support the legal conclusion of obviousness.

82 USPQ2d 1385, 1396 (2007) (quoting In re Kahn, 78 USPQ2d 1329, 1336 (Fed. Cir. 2006).

Further, a recent Board decision supports the view that an Examiner cannot skip a claim limitation when rejecting a claim as being obvious:

When determining whether a claim is obvious, an examiner must make 'a searching comparison of the claimed invention – including all its limitations – with the teaching of the prior art.' In re Ochiai, 71 F.3d 1565, 1572 (Fed. Cir. 1995). Thus, 'obviousness requires a suggestion of all limitations in a claim.' CFMT, Inc. v. Yieldup Intern. Corp., 349 F.3d 1333, 1342 (Fed. Cir. 2003) (citing In re Royka, 490 F.2d 981, 985 (CCPA 1974)).

In re Wada and Murphy, Appeal No. 2007-3733, Page 9 (January 14, 2008).

In the present instance, the June 24, 2010 Office Action contains both factual errors and legal errors with respect to the interpretation of the teachings of the prior art. As such, the Examiner failed to establish a *prima facie* case of obviousness and the claims of the present application are patentable over the cited prior art.

I. Rivett et al. Or Aversano, Alone Or In Combination Fail To Disclose, Teach Or Suggest The Claimed Subject Matter.

In the June 24, 2010 Office Action, the Examiner rejected claims 1, 3-5, 7-17, 20, 22-24 and 26-27 under 35 U.S.C. §103(a) as allegedly unpatentable over Rivett et al. in view of Aversano and rejected claim 18 under 35 U.S.C. §103(a) as allegedly unpatentable over Rivett et al. in view of Aversano and further in view of Ramsbottom et al. These rejections should be reversed. The Examiner failed to establish a *prima facie* case of obviousness since Rivett et al. and Aversano, alone or in combination, fail to disclose, teach or suggest the subject matter of the claims of the present application, particularly independent claims 1, 13, 16, 26 and 27. Specifically, Rivett et al. and Aversano alone or in combination fail to disclose, teach or suggest at least the following claimed subject matter of the independent claims:

- A film including an effective amount of a nitrogen oxide-containing compound capable of interacting with a food product or in contact with a food product. (Claims 1, 13, 16 and 27.)
- Contacting a viewable surface of a food product with an effective amount of a nitrogen oxide-containing compound to release the compound into contact with the food product in a controlled manner. (Claim 26.)
- An amount of nitrogen oxide-containing compound capable of creating and stabilizing a desirable color in a food product. (Claims 1, 13, 16, 26 and 27.)
- An amount of nitrogen oxide-containing compound insufficient to effectively cure an entire food product. (Claims 1, 13, 16, 26 and 27)

Appellants contend that the Examiner erred in finding each of these features disclosed, taught or suggested by Rivett et al. and Aversano, alone or in combination.

A. **Rivett et al. And Aversano, Alone Or In Combination, Fail To Disclose, Teach Or Suggest A Film Including An Effective Amount Of A Nitrogen Oxide-Containing Compound Or Contacting A Viewable Surface Of A Food Product With An Effective Amount Of A Nitrogen Oxide-Containing Compound.**

Rivett et al. and Aversano, alone or in combination, fail to disclose, teach or suggest (1) a film including an effective amount of a nitrogen oxide-containing compound or (2) contacting a viewable surface of a food product with an effective amount of a nitrogen oxide-containing compound. As mentioned above, the independent claims recite a film comprising an effective amount of a nitrogen oxide-containing compound and/or contacting a viewable surface of a food product with an effective amount of a nitrogen oxide-containing compound. In rejecting claims 1, 3-4, 7-9 and 13-15, the Examiner states,

With regard to Claim 1, 3-4, 7-9 and 13-15, Rivett et al disclose a food packaging film comprising **a food [contact] layer** capable of contacting a myoglobin food product, **comprising a preservative** (meat preservative; paragraph 0065) held within a package formed within the film (paragraph 0025); the film also comprises an oxygen barrier layer (paragraph 0055). . . . **Rivett et al fail to disclose a preservative comprising a nitrogen oxide-containing compound and capable of interacting with the food product to produce a desirable color.**

June 24, 2010 Office Action, Page 3, Number 5 (emphasis added). In support of his conclusion that Rivett et al. disclose a food contact layer comprising a preservative, the Examiner cites the following excerpt from Rivett et al.:

One or more layers of the peelable film may include one or more additives useful in packaging films, such as, antiblocking agents, slip agents, antifog agents, colorants, pigments, dyes, flavorants, antimicrobial agents, meat preservatives, antioxidants, fillers, radiation stabilizers, and antistatic agents. Such additives, and their effective amounts, are known in the art. The additive in the peelable film should be limited to an amount that does not interfere with the peelable properties of the film to an undesired extent.

Rivett et al., Page 6, Paragraph 65. However, a fair and accurate reading of Rivett et al. reveals that Rivett et al. provide no disclosure, suggestion or teaching of a food contact layer comprising a preservative.

Rivett et al. disclose a peelable film for peelably sealed packaging that may package food. The peelable film may be a monolayer film or a multilayer film and includes at least one peelable layer. This peelable layer may be an inner layer having both surfaces directly adhered to other

layers or may be an outer layer having only one surface directly adhered to another layer. Rivett et al. Page 2, Paragraph 26. The multilayer film may include one or more layers in addition to the peelable layer. Rivett et al., Page 4, Paragraph 43. These additional layers may be an inside layer, an outside layer, a gas barrier layer, a tie layer, an abuse layer or a bulk layer. Rivett et al., Page 4, Paragraph 45. Any one or more of these layers may include one or more additives. These additives include antiblocking agents, slip agents, antifog agents, colorants, pigments, dyes, flavorants, antimicrobial agents, meat preservatives, antioxidants, fillers, radiation stabilizers and antistatic agents. Rivett et al., Page 6, Paragraph 65. In other words, Rivett et al. merely suggests the possibility of one of thirteen different film additives that may be present in one of seven different film layers.

The Examiner asserts that the disclosure of seven different film layers and thirteen different film additives serves as a teaching of a food contact layer comprising a meat preservative. This assertion is contrary to the fact that Rivett et al. provide no direction or suggestion to choose any specific combination of film layer and additive. Rivett et al. discusses the possibility of using a variety of additives in a variety of layers under conditions (i.e., "not interfere[ing] with the peelable properties of the film to an undesired extent", see Rivett et al., Page 6, Paragraph 65.) in which the particular type of additive is of little significance to the overall teachings of Rivett et al. (i.e., teachings regarding a peelable sealed package comprising a web comprising a peelable layer comprising a blend and a substrate comprising a surface layer such that the peelable layer and the surface layer are peelable sealed to each other (see Rivett et al., Page 16, claim 1.)). As such, Rivett et al., does not provide one of ordinary skill in the art with sufficient guidance to arrive at a food contact layer comprising a meat preservative.

As noted above, the Examiner acknowledges that "Rivett et al fail to disclose a preservative comprising a nitrogen oxide-containing compound and capable of interacting with the food product to produce a desirable color." (June 24, 2010 Office Action, Page 3, Number 5.) To attempt to remedy this failure, the Examiner cites Aversano. However, Aversano does not remedy Rivett et

al.'s failure to teach a food contact layer comprising a preservative. Aversano teaches that the Aversano composition is applied directly to an edible product and not included in a film, let alone the food contact layer of a film. As disclosed in Aversano,

In accordance with the present invention a composition as aforesaid is **applied to the edible product** in an effective amount (Aversano, Column 2 lines 13-15, emphasis added.)

In accordance with the present invention, the product to be treated, such as cuts of meat or whole carcasses, may be treated by **dusting the exposed surfaces** with the composition of the present invention or by **spraying the surfaces** with a solution thereof. For carcasses, treatment may be accomplished by **injecting a solution of the composition of the present invention into the arteries and veins**. For ground meat, the treating materials may be **applied to the exposed surface** of the ground meat or **added to the meat before or during grinding** to permit distribution thereof throughout the ground mass. It is preferred in accordance with the present invention that the components thereof be thoroughly mixed together before application to the product. (Aversano, Column 2 lines 25-39, emphasis added.)

Aversano makes no mention of a food contact layer comprising a specific composition and does not remedy Rivett et al.'s lack of teaching of a food contact layer comprising a preservative.¹

Assuming *arguendo* that a food contact layer comprising a specific additive comprising a preservative was disclosed by Rivett et al. and Aversano, alone or in combination (which, as described above, it was not), the intended use of the meat preservative in the film of Rivett et al. is different than the intended use of the nitrogen oxide-containing compound in the claims of the present application. Therefore, contrary to the Examiner's implication, it is not obvious to

¹ The methods of Aversano (i.e., applying a composition directly to a food product as opposed to including a composition in a film) are similar to those disclosed by US Patent 3,360,381 ("Tarladgis"). As with Aversano, the teachings of Tarladgis are limited to applying a composition directly to a food product and do not include teachings regarding including such composition in a film. As explained by Tarladgis,

In carrying out the invention, fresh meat is soaked for one minute in a water solution Column 3 lines 3-4.

When fresh meat is to be dehydrated or freeze-dried, it is cut into slices one inch thick and then soaked for ten minutes in a water solution Column 3 lines 6-8.

In carrying out the invention with respect to cured meats, the fresh meat is ground and mechanically mixed or stirred with a mixture Column 3 lines 70-72.

As with Aversano and Rivett et al., Tarladgis makes no mention of a food contact layer comprising a specific composition and does not remedy Aversano and Rivett et al.'s lack of teachings of a food contact layer comprising a preservative.

substitute a meat preservative with a nitrogen oxide-containing compound. As mentioned above, a meat preservative is among the list of thirteen general categories of additives disclosed by Rivett et al. However, Rivett et al. provide no definition or examples of a "meat preservative." The Random House Dictionary defines a preservative as "a chemical substance used to preserve foods or other organic materials from decomposition or fermentation." In contrast, the present application describes the use of the nitrogen oxide-containing compound as follows:

It is a primary object of the present invention to ***cause and maintain the preferred red color*** on the surface of fresh meat. The color of interest is that typically associated with fresh meat that has been exposed to oxygen to create the oxygenated red form of the meat pigment. The present method achieves this goal by using nitrite or nitrate compounds in a packaging format that significantly ***extends the desirable color*** of a meat food product. More specifically, the present invention ***causes and maintains the preferred red color*** by using nitrite or nitrate in a manner that allows reaction with the myoglobin pigment of meat to form nitroxymyoglobin as defined herein.

Original application as filed, Page 9 lines 22-29, emphasis added. Additionally, in describing the examples of Figures 2A and 2B, the present application explains,

The sealing layer 24 includes an amount of an oxide of nitrogen, a nitrite or a nitrate compound 30 that is used to ***control the exhibited color*** of the food product 12.

Original application as filed, Page 13 lines 12-14, emphasis added. One of ordinary skill in the art would understand the meat preservative of Rivett et al. to be a chemical substance used to ***preserve meat from decomposition or fermentation*** and not a nitrogen oxide-containing compound used to ***cause, maintain, extend and/or control a desired color***.

In concluding that Rivett et al. and Aversano, alone or in combination, teach a food contact layer comprising a preservative and that a preservative for preserving meat from decomposition or fermentation is synonymous with a nitrogen oxide-containing compound for causing, maintaining, extending and/or controlling a desired color, the Examiner has simply retraced the path of the inventors of the claims of the present application with hindsight, discounting the number and complexity of the alternatives presented by Rivett et al. and Aversano (as explained below). This type of obviousness analysis is impermissible. As stated by the Federal Circuit in Orthopedic Equipment Company, Inc., et al. v. United States,

It is **wrong** to use the patent in suit as a guide through the maze of prior art references, combining the right references in the right way so as to achieve the result of the claims in suit. Monday morning quarterbacking is **quite improper** when resolving the questions of nonobviousness in a court of law.

217 USPQ 193, 199 (Fed. Cir. 1983) (emphasis added). For at least this reason alone, appellants respectfully submit that the Examiner failed to cite references disclosing, teaching or suggesting limitations of independent claims 1, 13, 16, 26 and 27, particularly, (1) a film including an effective amount of a nitrogen oxide-containing compound or (2) contacting a viewable surface of a food product with an effective amount of a nitrogen oxide-containing compound. As such, the Examiner failed to establish a *prima facie* case of obviousness. Not only each of claims 1, 3-4, 7-9 and 13-15 (as cited by the Examiner) but each of the claims of the present application (i.e., claims 1, 3-5, 7-18, 20, 22-24 and 26-27) is patentable under 35 U.S.C. § 103(a) over Rivett et al. in view of Aversano. Appellants respectfully request the rejection be reversed and the application remanded to the Examiner for immediate allowance of the pending claims (i.e., claims 1, 3-5, 7-18, 20, 22-24 and 26-27).

B. Rivett et al. And Aversano, Alone Or In Combination, Fail To Disclose, Teach Or Suggest An Amount Of Nitrogen Oxide-Containing Compound Capable Of Creating And Stabilizing A Desirable Color In A Food Product.

Rivett et al. and Aversano, alone or in combination, fail to disclose, teach or suggest an amount of nitrogen oxide-containing compound capable of creating and stabilizing a desirable color in a food product. As mentioned above, independent claims 1, 13, 16, 26 and 27 recite an amount of nitrogen oxide-containing compound capable of creating and stabilizing a desirable color in a food product. In rejecting claims 1, 3-4, 7-9 and 13-15, the Examiner states,

Rivett et al fail to disclose a preservative comprising a nitrogen oxide-containing compound and capable of interacting with the food product to produce a desirable color.

Aversano teaches the use of nitrites as preservatives, for color (column 2, lines 65-68), for meat (column 2, lines 20-24), for the purpose of using preservatives having well-known properties (the preservatives are known preservatives; column 2, lines 65-68).

It therefore would have been obvious for one of ordinary skill in the art to provide a preservative comprising a nitrate, therefore a nitrogen oxide-containing compound and capable of interacting with the food product to produce a desirable color, in order to provide preservatives having well-known properties as taught by Aversano.

June 24, 2010 Office Action, Page 3, Number 5. However, a fair and accurate reading of Aversano reveals the Examiner's conclusions are incorrect.

Consideration of the Aversano reference as a whole reveals that Aversano teaches a **multi-component** food preservative composition. Aversano, Column 2 line 14 ("In accordance with the present invention a composition as aforesaid. . .") and Column 2 lines 25-29 ("treated . . . with the composition of the present invention"). To be effective, Aversano teaches that the food preservative composition **must include 10 to 40% of at least four components**:

The composition consists essentially of 10 to 40% of each of the following components:

- (a) a material selected from the group consisting of ascorbic acid, the sodium and potassium salts thereof and mixtures thereof;
- (b) a material selected from the group consisting of citric acid, the sodium and potassium salts thereof and mixtures thereof;
- (c) a material selected from the group consisting of sodium carbonate, potassium carbonate and mixtures thereof; and
- (d) a material selected from the group consisting of sodium and potassium sulfite, bisulfite and metabisulfite and mixtures thereof.

Aversano, Column 1 line 67 to Column 2 line 12. The food preservative composition **may include additional** freshness or color preservatives such as nitrates, nitrites, phosphates, nicotinic acid or "other known color or freshness preservatives." Aversano, Column 2 lines 65-68. However, Aversano specifically teaches

The **surprising feature** of the composition of the present invention is the **synergistic combination of the components** thereof which effectively preserves color and freshness and retards bacterial growth for an inordinately long period of time far beyond what would normally be anticipated.

Aversano, Column 2 line 68 to Column 3 line 5, emphasis added. Aversano does not teach the use of the "additional freshness or color preservatives" as effective in and of themselves. In fact, a fair and accurate reading of Aversano reveals that Aversano teaches away from the use of these additional preservatives absent the four components (a), (b), (c) and (d) (listed above):

Conventional meat color preserving agents are known, such as ascorbic acid and/or nicotinic acid, which function by reacting with the myoglobin and hemoglobin either before or after they are oxidized to form a color which is relatively stable over longer periods of time. However, ***continued exposure to the air will cause a further oxidation reaction with a resultant undesirable change in the color of the meat product to brown or grey.***

Aversano, Column 1 lines 28 to 36, emphasis added. Aversano includes teachings that the "conventional" agents are useful only if used in combination with the four other components. If used alone, Aversano teaches that such "conventional" agents cause an "undesirable change in the color or the meat product to brown or grey." Aversano, Column 1 lines 35-36. Accordingly, one of ordinary skill in the art, when considering the Aversano reference, would be compelled to use a composition having at least the four other components in addition to the "conventional" agents. As such, Aversano teaches away from the use of "known color or freshness preservatives" in and of themselves.

Aversano further teaches away compositions that do not include ***equal amounts*** of each of the four components (a), (b), (c) and (d) (listed above). Aversano states, "Preferably, substantially equal quantities of each of the components are employed." Aversano, Column 2 lines 51-53. The importance of having all four components of the composition is further illustrated by Examples I, III, IV and VII. Example VII is specifically discussed in Column 5 line 10 to column 6 line 15, and the results are shown in Table II (reproduced below). Formulae I, II and IV of Table II consist of less than all four components of the composition and show inferior results indicated by loss of good color and decay in less than nine days. Formula V of Table II consists of all four components but in varying amounts (i.e., 85%, 10% 2.5% and 2.5%) and shows inferior results indicated by loss of good color and decay in less than ten days. Formula III of Table II consists of all four components in equal amounts and has good color characteristics for at least sixteen days.

TABLE II

Color of Meat Treated With Formula					
Day	I	II	III	IV	V
1	Good	Good	Good	Good	Good
2	Good	Good	Good	Good	Good
3	Good	Brown	Good	Good	Good
4	Brown	Dark Brown	Good	Good	Good
5	Dark Brown	Decayed	Good	Brown	Good
6	Decayed		Good	Dark Brown	Good
7			Good	Decayed	Brown
8			Good		Dark Brown
9			Good		Decayed
10			Good		
11			Good		
12			Good		
13			Good		
14			Good		
15			Good		
16			Good		

One or ordinary skill in the art, when considering the Aversano reference would be compelled to use a composition having **four components in equal amounts**. However, as described in the claims of the present application, appellants use a nitrogen oxide-containing compound that Aversano teaches causes "a resultant undesirable change in the color of the meat product to brown or grey" in and of itself. Aversano, Column 1 lines 34-36. Aversano teaches away from any composition with less than the four components, any composition with less than the four components in equal amounts and any composition with only "known color or freshness preservatives."

As stated by the Federal Circuit in In re Gurley,

A reference may be said to teach away when a person of ordinary skill, upon reading the reference, would be discouraged from following the path set out in the reference, or would be led in a direction divergent from the path that was taken by the applicant.

21 USPQ 2d 1130, 1131 (Fed. Cir 1994). Additionally, as stated by the Court in KSR International Co. v. Teleflex Inc.,

[W]hen the prior art teaches away from combining certain known elements, discovery of a successful means of combining them is more likely to be nonobvious.

82 USPQ2s 1385, 1395 (2007) (citing *United States v. Adams*, 383 U.S. 39, 51-52 (1996)). For at least this reason alone, appellants respectfully submit that the Examiner failed to cite references disclosing, teaching or suggesting limitations of independent claims 1, 13, 16, 26 and 27,

particularly, an amount of nitrogen oxide-containing compound capable of creating and stabilizing a desirable color in a food product. As such, the Examiner failed to establish a *prima facie* case of obviousness. Not only each of claims 1, 3-4, 7-9 and 13-15 (as cited by the Examiner) but each of the claims of the present application (i.e., claims 1, 3-5, 7-18, 20, 22-24 and 26-27) is patentable under 35 U.S.C. § 103(a) over Rivett et al. in view of Aversano. Appellants respectfully request the rejection be reversed and the application remanded to the Examiner for immediate allowance of the pending claims (i.e., claims 1, 3-5, 7-18, 20, 22-24 and 26-27).

The Examiner provides additional rejections related to a specific nitrogen oxide-containing compound capable of creating and stabilizing a desirable color in a food product (i.e., "sodium nitrite" as in claim 5 and 27). The Examiner states,

[B]ecause Aversano discloses nitrite, it would have been obvious for one of ordinary skill in the art to have provided for sodium nitrite, as sodium nitrite is a member of the group of nitrite salts.

June 24, 2010 Office Action, Pages 3-4, Number 5. However, even if sodium nitrite is a member of the group of nitrite salts, this supposed fact does not remedy the above-identified deficiencies of Rivett et al. and Aversano. For at least the reasons discussed above, each of claims 5 and 27 is nonobvious in view of Rivett et al. and Aversano, alone or in combination. As explained in the M.P.E.P.,

If an independent claim is nonobvious under 35 U.S.C. 103, then any claim depending therefrom is nonobvious.

§ 2143.03, Eighth Edition, Latest Revision July 2010, citing In re Fine, 5 USPQ2d 1596 (Fed. Cir. 1988). Claim 27 is an independent claim and, for at least the reasons discussed above, is nonobvious in view of Rivett et al. and Aversano, alone or in combination. Claim 5 depends, ultimately, from claim 1; and, for at least the reasons discussed above, claim 1 is nonobvious in view of Rivett et al. and Aversano, alone or in combination. Therefore, claim 5 is nonobvious in view of Rivett et al. and Aversano, alone or in combination. Appellants respectfully request the rejection be reversed and the application remanded to the Examiner for immediate allowance.

The Examiner also provides an additional rejection related to a specific amount of nitrogen oxide-containing compound capable of creating and stabilizing a desirable color in a food product (i.e., "at least 0.0008 milligram per square inch" as in claim 27). The Examiner states,

Aversano et al [sic] fail to disclose a nitrite comprising sodium nitrite in an amount sufficient to transfer between 0.0008 and 0.016 milligram per square inch to the product within 96 hours². . . . It . . . would have been obvious for one of ordinary skill in the art to have determined through routine optimization, the desired amount of sodium nitrite to the produce depending on the desired amount of coloring.

June 24, 2010 Office Action, Pages 3-4, Number 5. The Examiner has not provided any evidence explaining how or why one of ordinary skill in the art would "know" that a nitrogen oxide-containing compound in an amount sufficient to transfer at least 0.0008 milligram per square inch to uncooked meat product within 96 hours would be effective (i.e., would create and stabilize a desirable color in a food product) yet be insufficient to effectively cure the entire product. As noted above, the Examiner merely concludes that the described amount of nitrogen oxide-containing compound would be obvious to one of ordinary skill in the art. However, as noted above, it is incumbent upon the Examiner to provide a reason for his conclusion of obviousness. As stated by the Court in KSR International Co. v. Teleflex Inc.:

Rejections on obviousness grounds cannot be sustained by mere conclusory statements; instead, there must be some articulated reasoning with some rational underpinning to support the legal conclusion of obviousness.

82 USPQ2d 1385, 1396 (2007) (quoting In re Kahn, 78 USPQ2d 1329, 1336 (Fed. Cir.2006)). Furthermore, Rivett et al. and Aversano, alone or in combination, provide no quantitative suggestion or example of a concentration of nitrogen oxide-containing compound sufficient to create and stabilize a desirable color yet not effectively cure the entire product. Rivet et al. and Aversano, alone or in combination do not suggest a "finite number of identified predictable solutions" such that one of ordinary skill would have had "the reasonable expectation that at least

² The Examiner's recitation of the limitation as "amount sufficient to transfer between 0.0008 and 0.016 milligram per square inch to product within 96 hours" is incorrect. In appellants' January 22, 2010 reply to the July 22, 2009 Office Action, claim 27 was amended to replace "between 0.0008 and 0.016 milligram per square inch" with "at least 0.0008 milligram per square inch." Appellants respectfully request that the Examiner note the amendment.

one would be successful" in determining that a transfer of at least 0.0008 milligram per square inch causes the color change and insufficient curing described in the present application. See MPEP, §2143(E), Eighth Edition, August 2001, Latest Revision July 2010, citing Ex parte Kubin, 83 USPQ2d 1410 (Bd. Pat. App. & Int. 2007). For at least these reasons alone, appellants respectfully submit that the Examiner failed to cite references disclosing, teaching or suggesting limitations of claim 27. As such, the Examiner failed to establish a *prima facie* case of obviousness. Not only claim 27 (as cited by the Examiner) but each of the claims of the present application is patentable under 35 U.S.C. § 103(a) over Rivett et al. in view of Aversano. Appellants respectfully request the rejection be reversed and the application remanded to the Examiner for immediate allowance of the pending claims (i.e., claims 1, 3-5, 7-18, 20, 22-24 and 26-27).

C. Rivett et al. And Aversano, Alone Or In Combination, Fail To Disclose, Teach Or Suggest An Amount of Nitrogen Oxide-Containing Compound Insufficient To Effectively Cure An Entire Food Product.

Rivett et al. and Aversano, alone or in combination, fail to disclose, teach or suggest an amount of nitrogen oxide-containing compound insufficient to effectively cure an entire food product. As mentioned above, independent claims 1, 13, 16, 26 and 27 recite an amount nitrogen oxide-containing compound insufficient to effectively cure an entire food product. In rejecting claims 1, 3-4, 7-9 and 13-15, the Examiner states,

[C]uring is not disclosed by Rivett et al; the claimed aspect of insufficiency to cure the entire myoglobin-containing food product is therefore disclosed of Rivett et al.

June 24, 2010 Office Action, Page 3, Number 5. The Examiner has cited no actual facts or other disclosure in Rivett et al. and Aversano, alone or in combination, teaching an amount of nitrogen oxide-containing compound insufficient to effectively cure an entire food product. The Examiner fails to provide any evidence, cite any reference or otherwise explain how or why one of ordinary skill in the art would conclude that Rivett et al.'s *silence* regarding curing equates to Rivett et al.'s

disclosure of insufficiency to cure. The Examiner merely states that this would be the “obvious” conclusion. However, such statement and conclusion is contrary to established case law. As stated by the U.S. Court of Customs and Patent Appeals in 1966,

Silence in a reference is hardly a proper substitute for an adequate disclosure of facts from which a conclusion of obviousness may justifiably follow.

In re Burt and Walter, 148 USPQ 548, 553 (CCPA 1966), emphasis added. The absence of any statement regarding curing does not imply that actual insufficient curing (as in the claims of the present application) is disclosed. The absence of any such a statement in Rivett et al. says nothing about whether curing does or does not actually occur with the peelable film for peelably sealed packaging disclosed in Rivett et al. To conclude otherwise is erroneous. For at least this reason alone, appellants respectfully submit that the Examiner failed to cite references disclosing, teaching or suggesting limitations of independent claims 1, 13, 16, 26 and 27, particularly, an amount of nitrogen oxide-containing compound insufficient to effectively cure an entire food product. As such, the Examiner failed to establish a *prima facie* case of obviousness. Not only each of claims 1, 3-4, 7-9 and 13-15 (as cited by the Examiner) but each of the claims of the present application (i.e., claims 1, 3-5, 7-18, 20, 22-24 and 26-27) is patentable under 35 U.S.C. § 103(a) over Rivett et al. in view of Aversano. Appellants respectfully request the rejection be reversed and the application remanded to the Examiner for immediate allowance of the pending claims (i.e., claims 1, 3-5, 7-18, 20, 22-24 and 26-27).

D. Rivett et al., Aversano And Ramsbottom et al., Alone Or In Combination, Fail To Disclose, Teach Or Suggest The Subject Matter Of Dependent Claim 18.

In the June 24, 2010 Office Action, the Examiner rejected claim 18 under 35 U.S.C. §103(a) as allegedly unpatentable over Rivett et al. in view of Aversano and further in view of Ramsbottom et al. Claim 18 reads as follows:

The method of claim 17 further comprising the step of introducing other non-oxygen gases or mixture of non-oxygen gases between the film and the food item after evacuating the oxygen.

The rejection of claim 18 should be reversed because the Examiner failed to establish a *prima facie* case of obviousness. As described above, Rivett et al., Aversano and Ramsbottom et al., alone or in combination, fail to disclose, teach or suggest at least the following claimed subject matter of independent claim 16, the claim from which claim 18 ultimately depends:

- A film including an effective amount of a nitrogen oxide-containing compound capable of interacting with a food product or in contact with a food product.
- An amount of nitrogen oxide-containing compound capable of creating and stabilizing a desirable color in a food product.
- An amount of nitrogen oxide-containing compound insufficient to effectively cure an entire food product.

As previously stated, the missing elements of claim 16 noted above are simply not present nor suggested by Rivett et al. and Aversano. Ramsbottom et al. fail to cure this deficiency, and the Examiner does not contend that Ramsbottom et al. cure this deficiency. Thus, a *prima facie* case of obviousness has not been established. As explained in the M.P.E.P.,

If an independent claim is nonobvious under 35 U.S.C. 103, then any claim depending therefrom is nonobvious.

§ 2143.03, Eighth Edition, Latest Revision July 2010, citing In re Fine, 5 USPQ2d 1596 (Fed. Cir. 1988). For at least this reason alone, appellants respectfully submit that the Examiner failed to establish a *prima facie* case of obviousness and claim 18 of the present application is patentable under 35 U.S.C. § 103(a) over Rivett et al. in view of Aversano and further in view of Ramsbottom et al. Appellants respectfully request the rejection be reversed and the application remanded to the Examiner for immediate allowance.

II. The Examiner Failed To Consider All The Claims Limitations And Made Impermissible Conclusory Statements.

As noted above, the Examiner provides the following explanation for rejecting claims 1, 3-4, 7-9 and 13-15:

With regard to Claim 1, 3-4, 7-9 and 13-15, Rivett et al disclose a food packaging film comprising a food [contact] layer capable of contacting a myoglobin food product, comprising a preservative (meat preservative; paragraph 0065) held within a package formed within the film (paragraph 0025); the film also comprises an oxygen barrier layer (paragraph 0055); curing is not disclosed by Rivett et al; the claimed aspect of insufficiency to cure the entire myoglobin-containing food product is therefore disclosed of Rivett et al. Rivett et al fail to disclose a preservative comprising a nitrogen oxide-containing compound and capable of interacting with the food product to produce a desirable color.

Aversano teaches the use of nitrites as preservatives, for color (column 2, lines 65-68), for meat (column 2, lines 20-24), for the purpose of using preservatives having well-known properties (the preservatives are known preservatives; column 2, lines 65-68).

It therefore would have been obvious for one of ordinary skill in the art to provide a preservative comprising a nitrate, therefore a nitrogen oxide-containing compound and capable of interacting with the food product to produce a desirable color, in order to provide preservatives having well-known properties as taught by Aversano.

June 24, 2010 Office Action, Page 3, Number 5. Above, appellants discussed the deficiencies of such rejection with regard to claim 1 and, in part, with regard to claim 13. Additionally, appellants note that claim 13 has further limitations not addressed by the Examiner. In rejecting claim 13, the Examiner failed to address the limitation of a food packaging container comprising a tray adapted to hold a food item and a film positioned over the tray to maintain the food item. With the above rejection, the Examiner also failed to address further limitations of claims 3-4, 7-9 and 14-15. With the above rejection of claim 3, the Examiner did not address the limitation of a nitrogen oxide-contained compound forming nitric oxide when contacted with product. With the above rejection of claim 4, the Examiner did not address the limitation of a nitrogen oxide-containing compound as a nitrite. With the above rejection of claim 7, the Examiner did not address the limitation of a nitrogen oxide-containing compound applied to a surface of a food contact layer. With the above rejection of claim 8, the Examiner did not address the limitation of a nitrogen oxide-containing compound incorporated into a food contact layer. With the above rejection of claim 9, the Examiner did not address the limitation of a packaging film further comprising at least one additional layer positioned on a food contact layer. With the above rejection of claim 14, the Examiner did not address the limitation of a film used to vacuum package a food item in a tray and substantially eliminate the presence of oxygen between a film and a tray. With the above rejection

of claim 15, the Examiner did not address the limitation of a tray comprising a nitrogen oxide-containing compound. Therefore, the Examiner failed to address each of the limitations of claims 3-4, 7-9 and 13-15.

In rejecting claim 11, the Examiner states,

With regard to Claim 11, at least one additional film layer is disposed on the food contact layer comprising an adhesive layer (the film is a multiple layer film; paragraph 0043).

June 24, 2010 Office Action, Page 4, Number 5. However, claim 11 reads as follows³:

11. The packaging film of claim 10 wherein the adhesive comprises the nitrogen oxide-containing compound.

With this rejection of claim 11, the Examiner failed to address the limitation of an adhesive comprising a nitrogen oxide-containing compound and, consequently, failed to address each of the limitations of claim 11.

In rejecting claims 12 and 17, the Examiner states,

With regard to Claims 12 and 17, vacuum packaging is disclosed by Rivett et al (paragraph 0081).

June 24, 2010 Office Action, Page 4, Number 5. However claims 12 and 17 read as follows:

12. The food packaging film of claim 1 wherein the film is adapted to vacuum package the food item.

17. The method of claim 16 further comprising the step of evacuating oxygen from between the film and the food item after contacting the film with the food item.

With this rejection of claim 12, the Examiner failed to address the limitation of a film comprising an effective amount of a nitrogen oxide-containing compound (per claim 1 of the present application) being adapted to vacuum package a food item. Paragraph 81 of Rivett et al., cited by the Examiner, discloses that the **substrate** of Rivett et al. may be used in vacuum skin packaging methods. However, the Examiner fails to cite any portions of Rivett et al. that disclose that the

³ The Examiner's recitation of the limitation as "at least one additional film layer is disposed on the food contact layer comprising an adhesive layer" is incorrect. In appellants' January 22, 2010 reply to the July 22, 2009 Office Action, claim 11 was amended to replace "at least one additional film layer is disposed on the food contact layer" with "adhesive comprises the nitrogen oxide-containing compound." Appellants respectfully request that the Examiner note the amendment.

substrate includes an effective amount of a nitrogen oxide-containing compound. Paragraph 65 of Rivett et al., cited by the Examiner, is limited to the variety of different additives that the **peelable film, not the substrate**, may include in one or more of its multiple layers. Furthermore, with this rejection of claim 17, the Examiner failed to address the step of evacuating oxygen from between a film and a food item after contacting a film with a food item. Rivett et al.'s general disclosure of the use of the substrate in vacuum skin packaging methods does not address the specific order of the steps. Furthermore, as above, Rivett et al.'s general disclosure does not address the evacuation of oxygen specifically between a film including an oxide of nitrogen (per claim 16 of the present application) and a food item. Therefore, the Examiner failed to address each of the limitations of claims 12 and 17.

As instructed by the M.P.E.P.,

"All words in a claim must be considered in judging the patentability of that claim against the prior art." In re Wilson, 424 F.2d 1382, 1385, 165 USPQ 494, 496 (CCPA 1970).

M.P.E.P. § 2143.03, Eighth Edition, Latest Revision July 2010 (under the heading "All Claim Limitations Must Be Considered"). As noted above, in In re Wada and Murphy, the Board of Patent Appeals and Interferences confirmed this requirement:

When determining whether a claim is obvious, an examiner must make "a searching comparison of the claimed invention – **including all its limitations** – with the teaching of the prior art." In re Ochiai, 71 F.3d 1565, 1572 (Fed. Cir. 1995) (emphasis added). Thus, "obviousness requires a suggestion of all limitations in a claim." CFMT, Inc. v. Yieldup Intern. Corp., 349 F.3d 1333, 1342 (Fed. Cir. 2003) (citing In re Royka, 490 F.2d 981, 985 (CCPA 1974)).

Appeal 2007-3733, Page 9 (BPAI 2008), emphasis in original. As listed above, in addition to incorrectly interpreting the teachings of Rivett et al. and Aversano in regard to claims 1, 5, 13, 16, 18, 26 and 27, the Examiner fails to cite prior art teaching or suggesting all limitations in each of claims 3-4, 7-9, 11-12, 13-15 and 17. Appellants respectfully request the rejections be reversed and the application remanded to the Examiner for immediate allowance.

Furthermore, in specifically rejecting claims 10, 16, 19, 20, 22-24 and 26, the Examiner used mere conclusory statements without any articulated reasoning or rational underpinning supporting the conclusion of obviousness. In rejecting claim 10, the Examiner states,

With regard to Claim 10, the food contact is adhered to the substrate and is **therefore** an adhesive layer.⁴

June 24, 2010 Office Action, Page 4, Number 5, emphasis added. In rejecting claims 16, 19,⁵ 22-24 and 26, the Examiner states,

With regard to Claims 16, 19, 22-24 and 26, Rivett et al et al [sic] **therefore** disclose release of the nitrogen-containing compound in a controlled manner and a method comprising providing the film with the oxide of nitrogen.

June 24, 2010 Office Action, Page 4, Number 5, emphasis added. And in rejecting claim 20, the Examiner states,

With regard to Claim 20, Rivett et al **therefore** disclose permeating the film with the oxide of nitrogen.

June 24, 2010 Office Action, Page 4, Number 5. As evidenced by the text of each of these rejections and by the particular use of “therefore,” the Examiner rejected claims 10, 16, 19, 20, 22-24 and 26 with impermissible conclusory statements. With each of these rejections, the Examiner failed to cite any reference or merely cited a reference as a whole. Appellants respectfully submit that these rejections violate 37 C.F.R. § 1.104(c)(2):

In rejecting claims for want of novelty or for obviousness, the examiner must cite the best references at his or her command. When a reference is complex or shows or describes inventions other than that claimed by the applicant, the particular part relied on must be designated as nearly as practicable. The pertinence of each reference, if not apparent, must be clearly explained and each rejected claim specified.

Furthermore, such rejections are contrary to established case law and the instructions of the M.P.E.P. The M.P.E.P. instructs,

⁴ The Examiner’s recitation of the limitation as “the food contact layer is an adhesive” is incorrect. In appellants’ January 22, 2010 reply to the July 22, 2009 Office Action, claim 10 was amended to replace “food contact” with “at least one additional.” Appellants respectfully request that the Examiner note the amendment.

⁵ In appellants’ January 22, 2010 reply to the July 22, 2009 Office Action, claim 19 was canceled. Appellants respectfully request that the Examiner note the amendment.

The key to supporting any rejection under 35 U.S.C. 103 is the clear articulation of the reason(s) why the claimed invention would have been obvious. The Supreme Court in KSR International Co. v. Teleflex Inc., 550 U.S. ____, ____, 82 USPQ2d 1385, 1396 (2007) noted that the analysis supporting a rejection under 35 U.S.C. 103 should be made explicit. The Federal Circuit has stated that "***rejections on obviousness cannot be sustained with mere conclusory statements; instead, there must be some articulated reasoning with some rational underpinning to support the legal conclusion of obviousness.***" In re Kahn, 441 F.3d 977, 988, 78 USPQ2d 1329, 1336 (Fed. Cir. 2006). See also KSR, 550 U.S. at ____, 82 USPQ2d at 1396 (quoting Federal Circuit statement with approval).

(M.P.E.P., § 2142, Eighth Edition, Latest Revision July 2010, emphasis added.) However, as described above, contrary to the C.F.R., established case law (as cited by the M.P.E.P.) and the M.P.E.P. instructions, the Examiner rejected claims 10, 16, 19, 20, 22-24 and 26 with mere conclusory statements and without any articulated reasoning or rational underpinning supporting the conclusion of obviousness. Appellants respectfully request the rejections be reversed and the application remanded to the Examiner for immediate allowance.

III. As The Cited Art Fails To Disclose, Teach Or Suggest The Claimed Subject Matter And As The Examiner Failed To Consider All The Claims Limitations And Made Impermissible Conclusory Statements, The Claims Are Patentable And In Condition For Allowance.

As described above, the cited art fails to disclose, teach or suggest the subject matter of each of claims 1, 3-5, 7-18, 20, 22-24 and 26-27. Furthermore, the Examiner failed to consider all the claim limitations and made impermissible conclusory statements. As such, the Examiner failed to establish a *prima facie* case of obviousness. Therefore, each of claims 1, 3-5, 7-17, 20, 22-24 and 26-27 is patentable under 35 U.S.C. § 103(a) over Rivett et al. in view of Aversano, and claim 18 is patentable under 35 U.S.C. § 103(a) over Rivett et al. in view of Aversano and further in view of Ramsbottom et al. Appellants respectfully request that the final rejections of record be reversed and that the application be remanded to the Examiner for immediate allowance of the pending claims.

Respectfully submitted,

Date: June 23, 2011

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Claims Appendix

1. (rejected) A food packaging film for use in creating and stabilizing a desirable color on a viewable surface of a raw myoglobin-containing food product without deleteriously affecting the subsurface color of the food product, the film comprising a food contact layer capable of contacting the food product held within a package formed with the film; wherein the film is a barrier to oxygen, wherein the film comprises an effective amount of a nitrogen oxide -containing compound, wherein the effective amount of the nitrogen oxide-containing compound is capable of interacting with the myoglobin-containing food product to produce the desirable color, and wherein the effective amount of the nitrogen oxide-containing compound is insufficient to effectively cure the entire myoglobin-containing food product.
2. (canceled)
3. (rejected) The packaging film of claim 1 wherein the nitrogen oxide -containing compound forms nitric oxide when contacted with the food product.
4. (rejected) The packaging film of claim 3 wherein the nitrogen oxide -containing compound is a nitrite.
5. (rejected) The packaging film of claim 4 wherein the nitrogen oxide -containing compound is a sodium nitrite.
6. (canceled)
7. (rejected) The packaging film of claim 1 wherein the nitrogen oxide -containing compound is applied to a surface of the food contact layer.
8. (rejected) The packaging film of claim 1 wherein the nitrogen oxide -containing compound is incorporated into the food contact layer.
9. (rejected) The packaging film of claim 1 further comprising at least one additional layer positioned on the food contact layer.
10. (rejected) The packaging film of claim 9 wherein the at least one additional layer is an adhesive.

11. (rejected) The packaging film of claim 10 wherein the adhesive comprises the nitrogen oxide-containing compound.

12. (rejected) The food packaging film of claim 1 wherein the film is adapted to vacuum package the food item.

13. (rejected) A food packaging container comprising:

- a) a tray adapted to hold a food item therein; and
- b) a film positioned over the tray to maintain the food item therein, the film including an effective amount of a nitrogen oxide-containing compound and adapted to be in contact with the food item held within the tray;

wherein the tray is a barrier to oxygen, wherein the film is a barrier to oxygen, wherein the effective amount of the nitrogen oxide-containing compound is capable of creating and stabilizing a desirable color on a viewable surface of the food item, and wherein the effective amount of the nitrogen oxide-containing compound is insufficient to effectively cure the entire food item.

14. (rejected) The food packaging container of claim 13, wherein the film is used to vacuum package the food item in the tray and substantially eliminate the presence of oxygen between the film and the tray.

15. (rejected) The food packaging container of claim 13 wherein the tray comprises the nitrogen oxide-containing compound.

16. (rejected) A method of packaging a food item to create and stabilize a desirable color on a viewable surface of the food item, the method comprising the steps of:

- a) providing a film including an oxide of nitrogen; and
- b) contacting the film with the food item to form a package for the food item;

wherein the film is a barrier to oxygen and wherein the oxide of nitrogen is in an amount that is insufficient to effectively cure the entire food item.

17. (rejected) The method of claim 16 further comprising the step of evacuating oxygen from between the film and the food item after contacting the film with the food item.

18. (rejected) The method of claim 17 further comprising the step of introducing other non-oxygen gases or mixture of non-oxygen gases between the film and the food item after evacuating the oxygen.
19. (canceled)
20. (rejected) The method of claim 16 wherein the step of providing a film including an oxide of nitrogen comprises permeating the film with the oxide of nitrogen.
21. (canceled)
22. (rejected) The method of claim 16 wherein the step of providing a film including an oxide of nitrogen comprises applying the oxide of nitrogen to a contact surface of the film which contacts the food item.
23. (rejected) The method of claim 16 further comprising the step of evacuating oxygen from between the film and the food item prior to contacting the film with the food item.
24. (rejected) The method of claim 16 further comprising the step of treating the food item with the oxide of nitrogen prior to contacting the film with the food item.
25. (canceled)
26. (rejected) A method for creating and stabilizing a desirable color in a food product, the method comprising the step of contacting a viewable surface of the food product with an effective amount of a nitrogen oxide-containing compound, wherein the step of contacting the viewable surface comprises releasing the nitrogen oxide-containing compound into contact with the food product in a controlled manner and in an amount insufficient to effectively cure the entire food product, and wherein oxygen is barred from the food product.
27. (rejected) A vacuum packaged meat comprising an uncooked meat product vacuum packaged in a multilayer polymeric film having a first oxygen barrier polymeric layer and a second surface layer containing an oxide of nitrogen, selected from the group consisting of sodium nitrite, sodium nitrate, potassium nitrite, potassium nitrate and blends thereof, in an effective amount, wherein the effective amount is sufficient to transfer at least 0.0008 milligram per square inch to

the uncooked meat product within 96 hours but is insufficient to effectively cure the entire uncooked meat product.

Evidence Appendices

Appellants have provided as separate appendices with this appeal brief copies of the following:

- Evidence Appendix A: Rivett, et al. (U.S. Patent Application Publication 2002/0172834) (23 pages)
- Evidence Appendix B: Aversano (U.S. Patent 4,476,112) (4 pages)
- Evidence Appendix C: Ramsbottom, et al. (U.S. Patent 2,621,129) (7 pages)

Copies of the appendices immediately follow the last page (page 39) of this appeal brief.

Related Proceedings Appendix

None.

All prior and pending appeals, judicial proceedings or interferences known to the appellants, the appellants' legal representative and the assignee which may be related to, directly affect, be directly affected by or have a bearing on the Board's decision in this appeal are listed on page six; however, the Board has not rendered any decision in any of the listed appeals. Therefore, there are no copies of any decisions for appellants to submit with this appeal brief, and appellants have included this Related Proceedings Appendix with the indication "None."

(19) **United States**

(12) **Patent Application Publication**
Rivett et al.

(10) Pub. No.: **US 2002/0172834 A1**

(43) Pub. Date: **Nov. 21, 2002**

(54) **PEELABLY SEALED PACKAGING**

(52) U.S. Cl. 428/515; 206/484; 383/109

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(57) **ABSTRACT**

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A peelably sealed package includes a web having a peelable layer and a substrate having a surface layer. The peelable layer includes a blend of: i) from about 3 to about 15 weight parts polybutylene, ii) from about 40 to about 75 weight parts ionomer, and iii) from about 20 to about 55 weight parts ethylene/unsaturated ester copolymer such as a vinyl ester of aliphatic carboxylic acid or an alkyl ester of acrylic or methacrylic acid. The surface layer of the substrate includes a polyethylene having a density of from about 0.915 to about 0.93 g/cc, an ionomer, or a mixture of these polymers. The peelable layer of the web and the surface layer of the substrate are peelably sealed to each other in one or more selected areas. The peelable layer may form a peelable seal having a peel strength that is essentially equivalent regardless of whether the contact surface of the substrate is a polyethylene or an ionomer.

(21) Appl. No.: **09/777,240**

(22) Filed: **Feb. 5, 2001**

Publication Classification

(51) Int. Cl.⁷ B65D 30/08

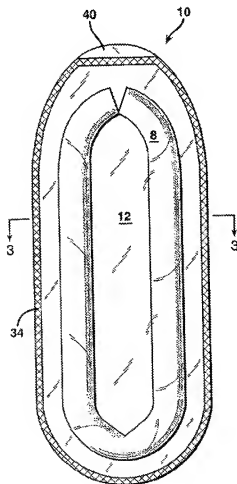


FIG. 1

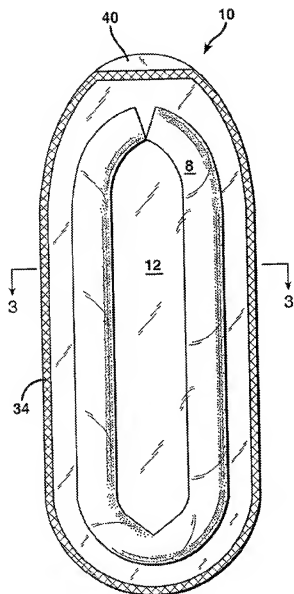


FIG. 2

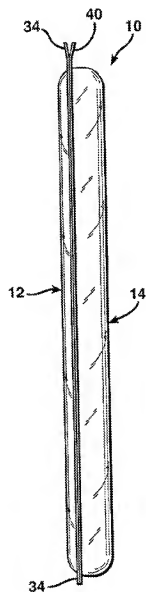


FIG. 3

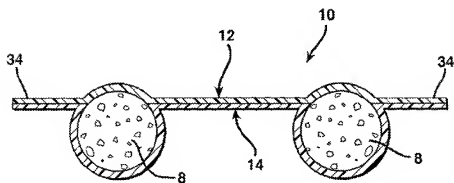


FIG. 6

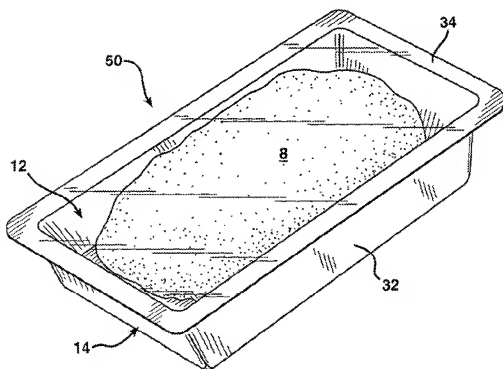


FIG. 4

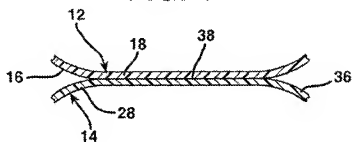


FIG. 5

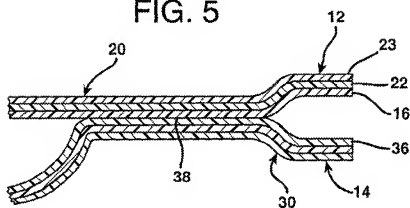


FIG. 7

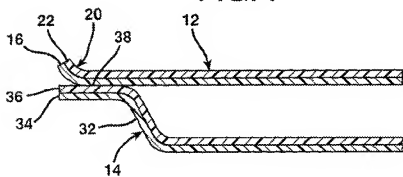


FIG. 8

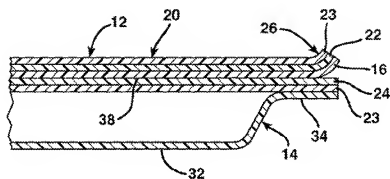


FIG. 9

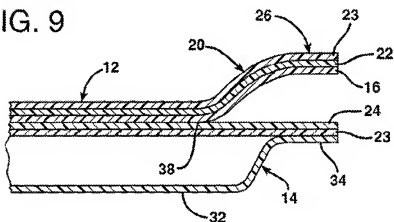
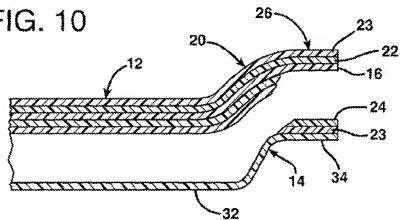


FIG. 10



PEELABLY SEALED PACKAGING

BACKGROUND OF THE INVENTION

[0001] The present invention relates to peelably sealed packaging, and more particularly to peelable films useful to incorporate in peelably sealed packaging.

[0002] Peelably sealed, "easy-open" packaging is used in a variety of food and non-food packaging applications to provide packaging that is easy for the consumer to open without having to tear the packaging. Peelably sealed packaging may take several forms. For example, a flexible film fidding or lid stock material may be peelably adhered to a rigid tray, tub, or container. Alternatively, the easy-open packaging may incorporate a peelable seal between a combination of one or more of flexible films, webs, substrates, or supports. Examples of this alternative include thermoforming and vacuum skin packaging methods known in the art. For example, the lower web or support (e.g., "formed web") may be heated and deep-drawn to form a receptacle for the item to be packaged. Once the item is placed on the support, the upper web (e.g., "non-formed web") is drawn over the item and peelably sealed to the peripheral edges of the support. The seal may be formed using heated sealing bars, platens, or frames to apply heat and pressure to the top and bottom webs in the seal area.

[0003] Other types of easy-open packaging may be formed using vertical-form-fill-seal (VFFS) or horizontal-form-fill-seal (HFFS) methods known in the art to form a pouch or bag containing the packaged product. In such alternatives, the peelable film or web may in effect be sealed to itself (i.e., the same type of film material may form both the top and bottom web of the packaging).

[0004] The layer of the peelable film that primarily facilitates the easy-open, peelable seal is known as the "peelable layer" or "separation layer." If the film is a mono-layer film, then the film itself may be considered the peelable layer. If the peelable layer is an outer layer of a multi-layer film, then the peelable layer is a sealant layer (e.g., heat-seal layer) of the film.

[0005] A peelable layer may also be an internal layer of a multi-layer film. In such an arrangement, one or more layers of a film may be hand peeled away (i.e., delaminated) from the remaining layers of the film, which remain attached to the substrate. This design may be used, for example, to peel away oxygen-impermeable layers of a film from the oxygen-permeable layers of the film at a desired time after the original construction of the packaging. Such a design is described, for example, in U.S. Pat. No. 5,919,547 issued Jul. 6, 1997 to Koerber, which is incorporated herein in its entirety by reference.

[0006] To open an easy-open packaging, the consumer simply grasps a portion of one web and pulls or "peels" it away from a second web or support—thereby causing the peelable seal to "fail." The type of failure depends on the design and location of the peelable layer. With an "interfacial peel" or "surface peel," the peelable layer may be located as an outer sealant layer of the top film, so that the top film separates from the substrate to which it adheres at the interface between the peelable layer of the top film and the substrate. Alternatively, with a "delamination peel," the peelable layer may be located as an internal layer of the top

film, so that the top film separates between the peelable layer and another layer of the top film (i.e., interlayer separation).

[0007] The peelable seal failure mechanism may be further classified as: 1) a "cohesive failure," in which the molecular attractive forces holding together the peelable layer composition are overcome, or 2) an "adhesive failure," in which the interfacial forces (e.g., valence forces or interlocking action or both) holding two surfaces together are overcome, or 3) a combination of both. Regardless of the type of peelable seal failure, it is desirable that the failure not cause "angel hair" or strings of resin to form or remain between the peeled layer and the substrate upon peeling.

[0008] The peelable seal should be sufficiently strong to withstand the expected abuse during the packaging operation, distribution, and storage. If the seal bond strength is too weak, then the package may open prematurely. However, the peelable seal must also provide a sufficiently low bond strength to allow the end-user to easily peel open the package by hand. If too high of a peel force is needed to open the peelably sealed packaging, then the peelable film may be considered "locked down"—that is, too hard to open easily by hand.

[0009] If the peelable layer of the film is an outer, sealant layer of the film, then it is desirable that the peelable layer have a relatively low heat seal initiation temperature in order to allow the equipment used to form the heat seals to run at relatively fast speeds. Further, it is also desirable that a packager be able to increase the bond strength of the peelable seal merely by increasing the heat seal temperature at which the peelable seal is made. This is because the packager may desire to form a less easily peeled seal for some applications (e.g., liquid packaging) than others (e.g., dry cereal packaging). However, it is also desirable that the peelable seal strength gradually increase as the sealing temperature increases, so that the sealing temperature does not have to be monitored so closely by the packager. Otherwise, a relatively small diff or variation in the sealing temperature that may be associated with the sealing equipment may cause a large variation in the peelable seal strength.

[0010] The bottom web or substrate of an easy-open package is often an ionomer-based surface or an LLDPE-based surface, depending on the packaging application and the desired performance attributes. However, existing peelable films that form an acceptable peelable seal at a given temperature with an ionomer-based surface generally do not tend to form an acceptable peelable seal at the same given temperature with an LLDPE-based surface. Conversely, peelable films that form an acceptable peelable seal at a given temperature with an LLDPE-based surface generally do not tend to form an acceptable peelable seal at the same given temperature with an ionomer-based surface. As a result, packagers that use both ionomer-surfaced substrates and LLDPE-surfaced substrates in providing easy-open packaging must currently purchase at least two separate types of top film or lid stock depending on the composition of the substrate. Further, to meet this demand, peelable film suppliers must be able to provide at least two types of computable top film or lid stock to the packagers. This increases the amount of peelable film inventory that the easy-open packager or peelable film supplier must carry—and also increases the complexity and cost of the manufacture of easy-open packaging.

SUMMARY OF THE INVENTION

[0011] The present invention addresses one or more of the aforementioned problems. A peelably sealed package includes a web having a peelable layer and a substrate having a surface layer. The peelable layer includes a blend of: i) from about 3 to about 15 weight parts polybutylene, ii) from about 40 to about 75 weight parts ionomer, and iii) from about 20 to about 55 weight parts ethylene/unsaturated ester copolymer. The unsaturated ester may be a vinyl ester of aliphatic carboxylic acid, where the vinyl ester has from 4 to 12 carbon atoms, or an alkyl ester of acrylic or methacrylic acid, where the alkyl ester has from 4 to 12 carbon atoms. The surface layer of the substrate includes a polyethylene having a density of from about 0.915 to about 0.93 g/cc, an ionomer, or a mixture of these polymers. The peelable layer of the web and the surface layer of the substrate are peelably sealed to each other in one or more selected areas.

[0012] In another aspect, a thermoplastic film useful as a peelable film has at least one layer comprising a blend of from about 3 to about 15 parts polybutylene, from about 40 to about 75 parts ionomer, and from about 20 to about 55 weight parts ethylene/unsaturated ester copolymer. The unsaturated ester is a vinyl ester of aliphatic carboxylic acid, where the vinyl ester has from 4 to 12 carbon atoms, or an alkyl ester of acrylic or methacrylic acid, where the alkyl ester has from 4 to 12 carbon atoms.

[0013] The inventive peelable film is useful in forming peelably sealed packaging. A packager may use the same peelable film with substrates having either a polyethylene contact surface or an ionomer contact surface—without having to significantly adjust or change the heat sealing temperature of the sealing equipment. This allows the packager to reduce the inventory of peelable film stock because the same peelable film may be used to form effective peelable seals with either type of substrate. Further, because the heat sealing temperature does not need to be adjusted, the use of the inventive peelable film enhances the flexibility and speed of changeover in packaging configurations between the ionomer and polyethylene surfaced substrates. Since the peel strength of the peelable seal increases as the heat seal temperature increases, the packager may increase the peel strength merely by increasing the heat seal temperature. Further, because the peel strength gradually increases with the increase in heat seal temperature, the packager does not have to monitor the sealing temperature so closely to avoid a relatively small drift or variation in the sealing temperature from causing a large change in the peel strength of the peelable seal.

[0014] These and other objects, advantages, and features of the invention will be more readily understood and appreciated by reference to the detailed description of the invention and the drawings.

BRIEF DESCRIPTION OF THE DRAWINGS

[0015] FIG. 1 is top view of a thermoformed, vacuum skin package made in accordance with the present invention;

[0016] FIG. 2 is a side elevational view of the package of FIG. 1;

[0017] FIG. 3 is a cross-sectional view taken along line 3-3 of FIG. 1;

[0018] FIG. 4 is a representational sectional view of the top and bottom webs of the package of FIG. 1 as peeling between the webs is initiated;

[0019] FIG. 5 is a representational sectional view of alternative top and bottom webs for the package of FIG. 1 as peeling between the webs is initiated;

[0020] FIG. 6 is a perspective view of a lidded, rigid tray made in accordance with the present invention;

[0021] FIG. 7 is a representational sectional view of the package of FIG. 6 as the lid web is surface peeled away from the tray;

[0022] FIG. 8 is a representational sectional view of an alternative embodiment of the package of FIG. 6 showing an alternative lid web as delamination peeling is initiated;

[0023] FIG. 9 is a representational sectional view of the package of FIG. 8 as delamination peeling is at a later stage than in FIG. 8; and

[0024] FIG. 10 is a representational sectional view of an alternative embodiment of the package of FIG. 8 showing an alternative easy open peel mechanism using a combination adhesive and cohesive fail mechanism.

DETAILED DESCRIPTION OF THE INVENTION

[0025] The peelably sealed packaging 10, 50 (FIGS. 1-3 and 6) of the present invention incorporates a peelable film 12 that may be sealed to a substrate 14 (FIGS. 4-5 and 7-10) or to itself. The peelable film includes at least one peelable layer 16 having a blend of polybutylene ("PB"), ionomer, and ethylene/unsaturated ester copolymer, such that the peelable layer is capable of forming an essentially equivalent peelable seal (at the same heat seal conditions) with either an ionomer-surfaced substrate or a polyethylene-surfaced substrate, as discussed in more detail below.

Peelable Film

[0026] The peelable film or web 12 may be a monolayer film 18 or multiple layer film 20. The peelable film includes at least one peelable or separation layer 16. If the film is monolayer, then the peelable layer 16 is the sole layer of the peelable film, in which case the terms "film" and "layer" have the same meaning. If the film is multilayered, then the peelable layer 16 may be an internal or inner layer of the film—that is, having both surfaces of the layer directly adhered to another layer of the film—in which case peelable film 12 is a delamination peelable film 26. (FIGS. 8-9.)

[0027] Alternatively, the peelable layer 16 may be an outer layer of the film—that is, having only one side directly adhered to another layer of the film (in the case of a multiple layer peelable film 20)—or having neither side directly adhered to another layer of the film (in the case of monolayer peelable film 18). If the peelable layer 16 is an outer layer of the peelable film 12, then the peelable layer 16 may be a sealant layer (e.g., heat-seal layer) of the peelable film to facilitate sealing the peelable film to substrate 14. (FIG. 5.)

Peelable Layer of the Peelable Film

[0028] The peelable layer includes a blend of polybutylene, ionomer, and ethylene/unsaturated ester copolymer.

Useful peelable layer thicknesses include those that range from about 0.25 to about 1.5 mil, about 0.25 to about 1 mil, about 0.25 to about 0.75 mil, about 0.5 to about 1 mil, and 0.5 to about 0.75 mil.

Polybutylene:

[0029] Polybutylene ("PB"), also known as polybutene-1, is derived from the polymerization of butene-1 monomer, with or without other olefin monomers (e.g., ethylene or alpha olefin monomers such as propylene, hexene, or octene). Accordingly, PB may be either a homopolymer or a copolymer. Useful PB copolymer may include less than about each of the following weight % non-butylene comonomer content: 10%, 8%, 6%, 4%, and 2%. Preferably, the comonomer, if present, is ethylene. PB is an isotactic, stereoregular, semi-crystalline thermoplastic polymer. The PB may be thermoplastic and/or elastomeric, but is preferably nonelastomeric. Examples of useful elastomeric PB are disclosed in U.S. Statutory Invention Registration H1583, corresponding to International Patent Application Publication WO 94/28066 published Dec. 8, 1994, each of which is incorporated herein in its entirety.

[0030] The PB in the blend acts as a "contaminant" or "incompatible" component to enhance the peelability of the peelable layer by weakening the seal between the peelable layer and the adjacent layer or substrate. For example, PB does not bond well to LDPE.

[0031] Examples of useful commercially available PB resins include those used in the examples below, and others available from Montell Polyolefins (now Basell) under the trademarks PB 1710A—which is believed to be a blend of 81.5 weight % PB 8640 (see PB3 in examples below), 7% polypropylene, and 1.5% HDPE—and DP 1560, which is believed to be a blend of 80 weight % PB 8640 and 20 weight % polypropylene.

[0032] The peelable layer blend may include from about 3 to about 15 weight parts PB, relative to the PB, ionomer, and ethylene/unsaturated ester copolymer content of the peelable layer. Other useful ranges of PB weight parts in the peelable layer include from about 5 to about 12, from about 5 to about 10, from about 6 to about 10, from about 7 to about 10, from about 9 to about 9, from about 5 to about 8, from about 6 to about 9, and from about 7 to about 8. The peelable layer may include from about 3 to about 15 weight % PB. Other useful ranges of PB weight % content in the peelable layer include from about 5 to about 12, from about 5 to about 10, from about 6 to about 10, from about 7 to about 10, from about 5 to about 9, and from about 5 to about 8, from about 6 to about 9, and from about 7 to about 8.

Ionomer

[0033] Ionomer is a copolymer of an ethylene and an ethylenically unsaturated monocarboxylic acid having the carboxylic acid groups partially neutralized by a metal ion, such as sodium or zinc, preferably zinc. Useful ionomers include those in which sufficient metal ion is present to neutralize from about 15% to about 60% of the acid groups in the ionomer. The carboxylic acid is preferably "(meth)acrylic acid"—which means acrylic acid and/or methacrylic acid. Useful ionomers include those having at least 50 weight % and preferably at least 80 weight % ethylene units. Useful ionomers also include those having from 1 to

20 weight percent acid units. Useful ionomers are also described in U.S. Pat. No. 3,355,319 and are available commercially from E. I. du Pont de Nemours and Company (Wilmington, Del.) under the trademark SURLYN, for example SURLYN 1652, SURLYN 1650, and SURLYN 1601.

[0034] The peelable layer blend may include from about 40 to about 75 weight parts ionomer, relative to the PB, ionomer, and ethylene/unsaturated ester copolymer content of the peelable layer. Other useful ranges of ionomer weight parts in the peelable layer include from about 45 to about 75, from about 50 to about 75, from about 55 to about 75, from about 60 to about 75, from about 40 to about 70, from about 40 to about 65, from about 40 to about 60, from about 40 to about 55, from about 45 to about 70, from about 50 to about 65, and from about 55 to about 60. The peelable layer may include from about 40 to about 75 weight % ionomer. Other useful ranges of ionomer weight % content in the peelable layer include from about 45 to about 75, from about 50 to about 75, from about 55 to about 75, from about 60 to about 75, from about 40 to about 70, from about 40 to about 65, from about 40 to about 60, from about 40 to about 55, from about 45 to about 70, from about 50 to about 65, and from about 55 to about 60.

Ethylene/Unsaturated Ester Copolymer

[0035] Ethylene/unsaturated ester copolymer is the copolymer of ethylene and unsaturated ester monomers. Useful unsaturated esters include: 1) vinyl esters of aliphatic carboxylic acids, where the esters have from 4 to 12 carbon atoms, and 2) alkyl esters of acrylic or methacrylic acid (collectively, "alkyl (meth)acrylate"), where the esters have from 4 to 12 carbon atoms.

[0036] Representative examples of the first ("vinyl ester") group of monomers include vinyl acetate, vinyl propionate, vinyl hexanoate, and vinyl 2-ethylhexanoate. The vinyl ester monomer may have from 4 to 8 carbon atoms, from 4 to 6 carbon atoms, from 4 to 5 carbon atoms, and preferably 4 carbon atoms.

[0037] Representative examples of the second ("alkyl (meth)acrylate") group of monomers include methyl acrylate, ethyl acrylate, n-butyl acrylate, n-butyl methacrylate, and 2-ethylhexyl acrylate, methyl methacrylate, ethyl methacrylate, n-butyl methacrylate, n-butyl methacrylate, hexyl methacrylate, and 2-ethylhexyl methacrylate. The alkyl (meth)acrylate monomer may have from 4 to 8 carbon atoms, from 4 to 6 carbon atoms, and preferably from 4 to 5 carbon atoms.

[0038] The unsaturated ester (i.e., vinyl ester or alkyl (meth)acrylate) comonomer content of the ethylene/unsaturated ester copolymer may range from about 6 to about 18 weight %, and from about 8 to about 12 weight %, based on the weight of the copolymer. Useful ethylene contents of the ethylene/unsaturated ester copolymer include the following amounts: at least about 82 weight %, at least about 85 weight %, at least about 88 weight %, no greater than about 94 weight %, no greater than about 93 weight %, and no greater than about 92 weight %, based on the weight of the copolymer. As the level of unsaturated ester comonomer increases, the ethylene/unsaturated ester copolymer tends to bond more strongly to ionomer and less strongly to LDPE. As the level of unsaturated ester comonomer decreases, then

converse tends to be true. This guidance is useful in selecting a desired level of unsaturated ester comonomer in the ethylene/unsaturated ester copolymer.

[0039] Representative examples of ethylene/unsaturated ester copolymers include ethylene/methyl acrylate, ethylene/methyl methacrylate, ethylene/ethyl acrylate, ethylene/ethyl methacrylate, ethylene/butyl acrylate, ethylene/2-ethylhexyl methacrylate, and ethylene/vinyl acetate.

[0040] Useful ethylene/alkyl (meth)acrylate copolymers are commercially available, for example, from Eastman Chemical Company (Kingsport, Tenn.), sold under the trademark EMAC and ExxonMobil Chemical Company (Houston, Tex.), sold under the trademark OPTEMA.

[0041] Useful EVA's are commercially available from E. I. du Pont de Nemours and Company (Wilmington, Del.) under the trademark ELVAX, for example, ELVAX 3165 (0.7 MI, 18% VA, 0.94 g/cc density), ELVAX 6440, ELVAX 3134 (9% VA), from Exxon Corporation under the trademark ESCORENE, for example, ESCORENE LD-318.92 (9% VA, 0.93 g/cc density, and 2.0 MI) and LD-761.36 T (15% VA, 3.6 MI, 0.933 g/cc density), and from Chevron Corporation under the PE5269 T trademark (6.5% VA, 0.5 MI, 0.9315 g/cc density). "MI" means melt flow index having the units of g/10 minutes (measured at 190° C. with a weight of 2.16 kg); "VA" means vinyl acetate, the content of VA comonomer in the EVA expressed as weight percent.

[0042] The peelable layer blend may include from about 20 to about 55 weight parts ethylene/unsaturated ester copolymer, relative to the PB, ionomer, and ethylene/unsaturated ester copolymer content of the peelable layer. Other useful ranges of ethylene/unsaturated ester copolymer weight parts in the peelable layer include from about 25 to about 55, from about 30 to about 55, from about 35 to about 55, from about 40 to about 55, from about 45 to about 55, from about 25 to about 50, from about 25 to about 45, from about 25 to about 40, from about 25 to about 35, from about 25 to about 50, from about 30 to about 45, from about 35 to about 50, from about 45 to about 50, and from about 40 to about 45. The peelable layer may include from about 20 to about 55 weight % ethylene/unsaturated ester copolymer. Other useful ranges of ethylene/unsaturated ester copolymer weight % content in the peelable layer include from about 25 to about 55, from about 30 to about 55, from about 35 to about 55, from about 40 to about 55, from about 45 to about 55, from about 25 to about 50, from about 25 to about 45, from about 25 to about 40, from about 25 to about 35, from about 25 to about 50, from about 30 to about 45, from about 35 to about 50, from about 45 to about 50, and from about 40 to about 45.

Other Layers of the Peelable Film

[0043] The multiple layer peelable film 20 includes one or more layers in addition to the peelable layer 16. Adjacent adhered layer 22 may be bonded, extruded, or adhered to the peelable layer 16, and is designed to form a bond strength to the peelable layer 16 (i.e., "interlayer bond strength") that is stronger than the peelable seal bond formed between the peelable layer 16 and either substrate 14 (in the case of FIGS. 5 and 7) or delamination film layer 24 (in the case of delamination peelable film 26, FIGS. 8-10).

[0044] The delamination film layer 24 of delamination peelable film 26 may include the ionomers and polyethy-

lenes as discussed with respect to the substrate surface layer 36 discussed below. For example, the delamination film layer 24 may comprise at least 70 weight percent, or at least 80 weight percent of such polyethylene or ionomer. Multiple layer film 20 may also include one or more additional layers 23.

[0045] The multiple layer peelable film 20 may include any number of layers 22, 23, 24 in addition to the peelable layer 16, for example the multiple layer peelable film may include a total of any of the following: from 2 to 20 layers, at least 3 layers, at least 4 layers, at least 5 layers, and from 5 to 9 layers. The multiple layer peelable film 20 may include one or more of each of: i) an inside layer (i.e., heat seal layer), ii) an outside layer (e.g., print side layer), iii) a gas barrier layer, iv) a tie layer, v) an abuse layer, and vi) a bulk layer. Below are some examples of combinations in which the alphabetical symbols designate the resin layers. Where the multilayer peelable film representation below includes the same letter more than once, each occurrence of the letter may represent the same composition or a different composition within the class that performs a similar function.

[0046] A/D, A/C/D, A/B/D, A/B/C/D, A/C/B/D, A/B/C/E/D, A/E/C/E/D, A/B/E/C/D, A/C/E/B/D, A/C/E/B/D, A/E/B/C/D, A/E/C/B/D, A/C/B/C/D, A/C/E/C/B/D, A/B/C/B/B/D, A/C/B/B/B/D, A/C/B/C/B/D, A/C/E/B/B/D, A/B/E/C/E/B/D, A/B/E/C/E/B/D, A/A/D, A/A/C/D, A/A/B/D, A/A/B/C/D, A/A/C/B/D, A/B/A/C/E/D, A/E/C/A/E/D, A/E/C/A/D, A/C/A/B/E/D, A/A/C/E/B/D, A/E/B/A/C/D, A/E/A/C/B/D, A/C/B/A/C/D, A/B/A/C/B/D, A/B/A/C/E/B/D, A/B/C/A/E/C/D, A/A/B/E/C/B/D, A/A/C/E/C/B/D, A/A/B/C/B/B/D, A/A/C/B/B/B/D, A/A/C/B/C/B/D, A/A/C/E/B/B/D, A/A/B/E/C/E/B/D, A/A/B/E/C/E/B/D

[0047] "A" is a heat seal layer, that is, a layer adapted to facilitate the heat-sealing of the film to itself or to another object, such as a substrate, as is known in the art. The "A" layer may be a peelable layer (i.e., layer 16).

[0048] "A'" is a peelable layer (i.e., layer 16) located as an inner or internal layer of the multiple layer film 20, in which case at least one layer adjacent to A' preferably comprises polyethylene having a density of from about 0.915 to about 0.93 g/cc or ionomer.

[0049] "B" is a core or bulk layer, as discussed below.

[0050] "C" is a barrier layer, as discussed below.

[0051] "D" is an outside (i.e., abuse or print side) layer, as discussed below.

[0052] "E" is a tie layer, as discussed below.

Core or Bulk Layers "B"

[0053] The peelable film 20 may include one or more layers to serve as core, bulk, and/or abuse layers. Such a layer may include one or more polymers that include resin units derived from at least one of a C₂-C₁₂ α -olefin, styrene, amides, esters, and urethanes. Preferred among these are those homo- and co-polymers (including isopolymers, etc.) that include resin units derived from ethylene, propylene, and 1-butene, even more preferably an ethylene copolymer such as, for example, ethylene/C₃-C₆ α -olefin copolymer, ethylene/ethylenically unsaturated ester copoly-

mer (e.g., ethylene/butyl acrylate copolymer), ethylene/ethylenically unsaturated acid copolymer (e.g., ethylene/methyl acrylic acid copolymer), and ethylene/vinyl acetate copolymer. Preferred ethylene/vinyl acetate copolymers are those that include from about 2.5 to about 27.5 weight %, preferably from about 5 to about 20%, even more preferably from about 5 to about 17.5% mer units derived from vinyl acetate. Such a polymer preferably has a melt index of from about 0.3 to about 25, more preferably from about 0.5 to about 15, still more preferably from about 0.7 to about 5, and most preferably from about 1 to about 3.

[0054] The peelable film may include one or more layers derived at least in part from a polyester and/or a polyamide. Examples of suitable polyesters include amorphous (copolyesters, poly(ethylene/terephthalic acid), and poly(ethylene/naphthalate), although poly(ethylene/terephthalic acid) with at least about 75 mole percent, more preferably at least about 80 mole percent, of its mer units derived from terephthalic acid may be preferred for certain applications. Examples of suitable polyamides include polyamide 6, polyamide 9, polyamide 10, polyamide 11, polyamide 12, polyamide 66, polyamide 610, polyamide 612, polyamide 6I, polyamide 6I, polyamide 69, copolymers made from any of the monomers used to make two or more of the foregoing homopolymers, and blends of any of the foregoing homo- and/or copolymers.

Barrier Layer "C"

[0055] The peelable film may include one or more barrier layers derived at least in part from the inside and outside layers. A barrier layer reduces the transmission rate of one or more components—, for example, gases or vapors—through the peelable film. Accordingly, the barrier layer of a film that is made into a package will help to exclude one or more components from the interior of the package—or conversely to maintain one or more gases or vapors within the package.

[0056] The barrier layer may include one or more of the following polymers in effective amounts: polyvinyl alcohol, acrylonitrile-butadiene copolymer, polyvinylidene chloride, polyalkylene carbonate, polyacrylonitrile, polypropylene homopolymer or copolymer having a melting point of greater than about 145° C. (as measured by DSC), and polyethylene having a density greater than about 0.95 g/cc. The term "highly crystalline" has a meaning understood to those of skill in the art. A component may be considered "highly crystalline" if the amount of crystalline molecules is at least 70 weight percent of the maximum amount of crystallinity.

[0057] If formulated as a gas barrier, the barrier layer preferably has a thickness and composition sufficient to impart to the peelable film an oxygen transmission rate of no more than any of the following 500, 150, 100, 50, 20, 15, and 10 cubic centimeters (at standard temperature and pressure) per square meter per day per 1 atmosphere of oxygen pressure differential measured at 0% relative humidity and 23° C. All references to oxygen transmission rate in this application are measured at these conditions according to ASTM D-3985, which is incorporated herein in its entirety by reference.

[0058] The barrier layer thickness may be in any of the following ranges: from about 0.05 to 9 mils, 0.05 to 4 mils, 0.1 to 3 mils, and 0.12 to 2 mils.

Outside Layer "D"

[0059] The outside layer (i.e., abuse or print side layer) of the peelable film 20 may be exposed to environmental stresses once the film is formed into a package. Such environmental stresses include abrasion and other abuse during processing and shipment. The outside layer preferably also provides heat-resistant characteristics to the film to help prevent "burn-through" during heat sealing. This is because in forming a package by conductance heat sealing the film to itself, the heat seal layer may be placed in contact with itself, while the outside layer is proximate a heated jaw of a heat sealing apparatus. The heat seal jaw transfers heat through the outside layer to the heat seal layer of the package to soften the heat seal layer and form the heat seal.

[0060] Further, the outside layer of the film provides the surface upon which the processor typically applies a printed image (e.g., printed information), such as by printing ink. As such, the outside layer is preferably capable of providing a surface that is compatible with selected print ink systems.

[0061] The outside layer may include one or more polyesters, polyamides, polyethylene, and/or polypropylene either alone or in combination, for example, any one of these types of components in an amount of at least 50 weight %, more preferably at least 70%, still more preferably at least 90%, and most preferably 100% by weight of the layer. The outside layer may have any of the following thicknesses: from about 0.05 to about 5 mils, from about 0.3 to about 4 mils, and from about 0.5 to about 3.5 mils.

Tie Layer "E"

[0062] The peelable film 20 may include one or more tie layers, which have the primary purpose of improving the adherence of two layers to each other. Tie layers may include polymers having grafted polar groups so that the polymer is capable of covalently bonding to polar polymers such as EVOH. Useful polymers for the layers include ethylene/unsaturated acid copolymer, ethylene/unsaturated ester copolymer, anhydride-modified polyolefin, polyurethane, and mixtures thereof. Examples of tie layer polymers include one or more of ethylene/vinyl acetate copolymer having a vinyl acetate content of at least 15 weight %, ethylene/methyl acrylate copolymer having a methyl acrylate content of at least 20 weight %, anhydride-modified ethylene/methyl acrylate copolymer having a methyl acrylate content of at least 20%, and anhydride-modified ethylene/alpha-olefin copolymer, such as an anhydride grafted LDDPE.

[0063] Modified polymers or anhydride-modified polymers include polymers prepared by copolymerizing an unsaturated carboxylic acid (e.g., maleic acid, fumaric acid), or a derivative such as the anhydride, ester, or metal salt of the unsaturated carboxylic acid with—or otherwise incorporating the same into—an olefin homopolymer or copolymer. Thus, anhydride-modified polymers have an anhydride functionality achieved by grafting or copolymerization.

[0064] The peelable film may include a tie layer directly adhered (i.e., directly adjacent) to one or both sides of an internal gas barrier layer. Further, a tie layer may be directly adhered to the internal surface of the outside layer of the film. The tie layers are of a sufficient thickness to provide the adherence function, as is known in the art. Each tie layer may be of a substantially similar or a different composition and/or thickness.

Additives

[0065] One or more layers of the peelable film may include one or more additives useful in packaging films, such as, antiblocking agents, slip agents, antifog agents, colorants, pigments, dyes, flavorants, antimicrobial agents, meat preservatives, antioxidants, fillers, radiation stabilizers, and antistatic agents. Such additives, and their effective amounts, are known in the art. The additive in the peelable film should be limited to an amount that does not interfere with the peelable properties of the film to an undesired extent.

Attributes of the Peelable Film

[0066] The peelable film of the present invention (e.g., peelable film 12 of FIGS. 1-10 or multiple layer peelable film 20 of FIGS. 5, 7-10) may have any total thickness as long as it provides the desired properties (e.g., flexibility, Young's modulus, optics, seal strength) for a given packaging application of expected use. Useful thicknesses for the peelable film include less than about each of the following: 15 mils, 12 mils, 10 mils, 5 mils, 4 mils, 3 mils, and 2 mils. (A "mil" is equal to 0.001 inch.) Useful thicknesses for the peelable film also include from at least about each of the following: 0.3 mils, 0.5 mils, 0.6 mils, 0.75 mils, 0.8 mils, 0.9 mils, 1 mil, 1.2 mil, 1.4 mil, and 1.5 mil. Useful ranges for the peelable film thickness include from about 0.5 to about 10 mils, from about 0.5 to about 7 mils, and from about 0.5 to about 5 mils.

[0067] The peelable film of the present invention preferably exhibits a Young's modulus sufficient to withstand the expected handling and use conditions. Young's modulus may be measured in accordance with one or more of the following ASTM procedures: D882; D5026-95a; D4065-89, each of which is incorporated herein in its entirety by reference. Useful peelable films include those having a Young's modulus of at least each of the following: about 100 MPa, about 200 MPa, about 300 MPa, and about 400 MPa, measured at 100° C. Useful ranges for Young's modulus for the peelable film include from about 70 to about 2000 MPa, from about 100 to about 1000 MPa, and from about 100 to about 500 MPa, measured at a temperature of 100° C.

[0068] The peelable film of the present invention may be non-oriented. Alternatively, the peelable film 12 may be oriented in either the machine (i.e., longitudinal), the transverse direction, or preferably in both directions (i.e., biaxially oriented), in order to reduce the permeability and to increase the strength and durability of the film. The peelable film may be oriented in at least one direction by any of the following ratios: at least 2.5:1, from about 2.7:1 to about 10:1, at least 2.8:1, at least 2.9:1, at least 3.0:1, at least 3.1:1, at least 3.2:1, at least 3.3:1, at least 3.4:1, at least 3.5:1, at least 3.6:1, and at least 3.7:1.

[0069] The peelable film of the present invention may be non-heat shrinkable—for example, having a total free shrink at 185° F. (85° C.) of less than about any of the following: 3%, 1%, and 0.5%. Alternatively, the peelable film 12 may be heat shrinkable, for example having a total free shrink at 185° F. (85° C.) of at least about any of the following: 5%, 10%, 15%, 40%, 50%, 55%, 60%, and 65%. The total free shrink at 185° F. (85° C.) may also range from any of the following: 40 to 150%, 50 to 140%, and 60 to 130%. The total free shrink is determined by summing the percent free

shrink in the machine (longitudinal) direction with the percentage of free shrink in the transverse direction. For example, a film which exhibits 50% free shrink in the transverse direction and 40% free shrink in the machine direction has a total free shrink of 90%. The peelable film need not have shrinkage in both directions. The free shrink of the film is determined by measuring the percent dimensional change in a 10 cm×10 cm film specimen when subjected to selected heat (i.e., at a certain temperature exposure) according to ASTM D 2732, which is incorporated herein in its entirety by reference.

[0070] As is known in the art, a heat-shrinkable film shrinks upon the application of heat while the film is in an unrestrained state. If the film is restrained from shrinking—for example by a packaged good around which the film shrinks—then the tension of the heat-shrinkable film increases upon the application of heat. Accordingly, a heat-shrinkable film that has been exposed to heat so that at least a portion of the film is either reduced in size (unrestrained) or under increased tension (restrained) is considered a heat-shrunk (i.e., heat-contracted) film.

[0071] The peelable film of the present invention may exhibit a shrink tension in at least one direction of any of the following: at least 100 psi (689.6 kN/m²), 175 psi (1206.8 kN/m²), from about 175 to about 500 psi (1206.8 to 3448.0 kN/m²), from about 200 to about 500 psi (1379.2 to 3448.0 kN/m²), from about 225 to about 500 psi (1551.6 to 3448.0 kN/m²), from about 250 to about 500 psi (1724.0 to 3448.0 kN/m²), from about 275 to about 500 psi (1896.4 to 3448.0 kN/m²), from about 300 to about 500 psi (2068.8 to 3448.0 kN/m²), and from about 325 to about 500 psi (2241.2 to 3448.0 kN/m²). Shrink tension is measured at 185° F. (85° C.) in accordance with ASTM D 2838, which is incorporated herein in its entirety by reference. The shrink tension of the peelable film should be low enough for a given end use and peelable film construction so as not to induce an undesired or premature peelable seal failure or delamination.

[0072] The peelable film 12 may be annealed or heat-set to reduce the free shrink either slightly, substantially, or completely; or the peelable film may not be heat set or annealed once stretched in order that the film will have a high level of heat shrinkability.

[0073] One or more of the layers of the peelable film 12 or 20—or at least a portion of the entire peelable film—may be cross-linked to improve the strength of the peelable film, improve the orientation of the peelable film, and help to avoid burn through during heat seal operations. Cross-linking may be achieved by using chemical additives or by subjecting the film layers to one or more energetic radiation treatments—such as ultraviolet, X-ray, gamma ray, beta ray, and high energy electron beam treatment—to induce cross-linking between molecules of the irradiated material. The peelable film may be exposed to any of the following radiation dosages: at least 5, at least 7, at least 10, and at least 15 kGy (kiloGrey). The radiation dosage may also range from 5 to 150, from 5 to 100, and from 5 to 75 kGy.

[0074] All or a portion of the peelable film's surface may be corona and/or plasma treated to change the surface energy of the peelable film, for example, to increase the ability of print or a food product to adhere to the peelable film. One type of oxidative surface treatment involves bringing the peelable film into the proximity of an O₂- or N₂-containing

gas (e.g., ambient air) which has been ionized. The peelable film may be treated to have a surface energy of any of the following: at least about 0.034 J/m², at least about 0.036 J/m², at least about 0.038 J/m², and at least about 0.040 J/m². The corona or plasma treatment of the peelable film should be limited to an amount that does not interfere with the peelable properties of the film to an undesired extent.

Appearance Characteristics of the Peelable Film

[0075] The peelable film 12 preferably has low haze characteristics. Haze is a measurement of the transmitted light scattered more than 2.5° from the axis of the incident light. Haze is measured against the outside layer of the peelable film. The "outside layer" is the outer layer of the film that will be adjacent the area outside of the package comprising the film. The "inside layer" is the outer layer of the film that will be adjacent the area inside of the package comprising the film. Haze is measured according to the method of ASTM D 1003, which is incorporated herein in its entirety by reference. All references to "haze" values in this application are by this standard. Preferably, the haze of the peelable film is no more than about (in ascending order of preference) 30%, 25%, 20%, 15%, and 10%; and further preferably the haze is no more than about any of these haze values where the peelable film has a thickness of no more than about 4 mils.

[0076] The peelable film 12 has a gloss, as measured against the outside layer of at least about (in ascending order of preference) 40%, 50%, 60%, 65%, 70%, 75%, 80%, 85%, 90%, and 95%. All references to "gloss" values in this application are in accordance with ASTM D 2457 (60° angle), which is incorporated herein in its entirety by reference.

[0077] Preferably, peelable film 12 is transparent (at least in the non-printed regions) so that a packaged article 8 may be visible through the film. "Transparent" means that the film transmits incident light with negligible scattering and little absorption, enabling objects (e.g., the packaged article or print) to be seen clearly through the film under typical viewing conditions (i.e., the expected use conditions of the material).

[0078] The measurement of optical properties of plastic films, including the measurement of total transmission, haze, clarity, and gloss, is discussed in detail in Pike, LeRoy, "Optical Properties of Packaging Materials," *Journal of Plastic Film & Sheeting*, vol. 9, no. 3, pp. 173-80 (July 1993), of which pages 173-80 is incorporated herein by reference.

Manufacture of the Peelable Film

[0079] The peelable film 12 may be formed by any of a variety of processes known in the art, including extrusion (e.g., blown-film extrusion, coextrusion, extrusion coating, free film extrusion, and lamination), casting, and adhesive lamination. One or more of these methods may be used to make a multilayer peelable film—that is, a peelable film having two or more layers coextensively bonded or adhered together. Coextrusion manufacture may use, for example, a tubular trapped bubble film process or a flat film (i.e., cast film or slit die) process.

[0080] If the peelable film is a cast film, then a relatively lower peel strength range (e.g., from 1 to 2 lbf/in) over the

heat seal temperature of from 120° C. to 150° C. may be desirable because of the more extensible nature of a cast film relative to a laminated film. This more extensible nature of a cast peelable film may tend to allow some of the peel force to be transferred away from the peelable layer to the adjacent layers. If the peelable film comprises a laminated structure, then a relatively higher peel strength range (e.g., from 1.5 to 2.5 lbf/in) over the heat seal temperature of from 120° C. to 150° C. may be desirable.

Substrate

[0081] Although the peelable film 12 may be sealed to itself (not shown) to form a peelably sealed package (for example, as in the VFPS or HFPS packaging methods known in the art), generally the peelable film 12 is sealed to a substrate 14 in one or more selected areas (e.g., perimeter area 34) to form the peelably sealed package 10. Substrate 14 may be flexible or rigid. Substrate 14 may be a monolayer substrate film 28 or a multilayer substrate film 30, such as those thermoplastic films used as the formed web (e.g., "bottom" web) of the thermoforming or vacuum shrink packaging methods known in the art. (FIGS. 4-5.) Alternatively, the substrate may include a flexible metal (e.g., aluminum foil) or cellulosic (e.g., paper) flexible substrate.

[0082] The substrate 14 may also be a monolayered or multilayered rigid support, such as a plastic or comrigated backing board (not shown), having a surface film layer, coating or other modification to facilitate sealing to the peelable film, or rigid tray 32 having perimeter flange 34 (FIGS. 6-10) with a similar film layer, coating or modification at least in the flange area to facilitate sealing to the peelable film. The rigid trays or supports may be formed from thermoset plastics, thermoplastics (e.g., expanded polystyrene sheet material which has been thermoformed into a desired shape), cellular or foamed plastics (e.g., extruded polystyrene foam sheet), metal, or combinations thereof.

[0083] In either the flexible or rigid substrate cases, the substrate 14 preferably has a contact surface layer 36 (e.g., coating or modification) to facilitate heat sealing the substrate 14 to the peelable film 12. If the substrate is monolayered (e.g., uncoated), then the substrate itself may serve as the contact or surface layer 36. At least two types of thermoplastics are in wide use to form the substrate surface layer 36: ionomer and polyethylene. Typical or popular ionomers for use in the substrate surface layer are the same and similar to those discussed above in conjunction with the peelable seal layer. Typical or popular polyethylenes for inclusion in the substrate surface layer include polyethylene homopolymers and copolymers having a density of from about 0.915 to about 0.93 g/cc. (Unless otherwise stated, all densities are at 23° C.) The contact layer may comprise at least 70 weight percent, or at least 80 weight percent of such polyethylene or ionomer.

[0084] Polyethylenes having a density of from about 0.915 to about 0.93 g/cc include low density polyethylene ("LDPE"), for example having a density of from about 0.915 to about 0.925 g/cc, linear low density polyethylene ("LLDPE"), for example having a density of from about 0.920 to about 0.930 g/cc, and other heterogeneous or homogeneous ethylene/alpha-olefin copolymers ("EAOs") having a density of from about 0.915 to about 0.93 g/cc. The

comonomer of the EAO may be selected from C_3 to C_{19} alpha-olefins. The EAO may include at least about 80 weight percent ethylene and less than about 20 weight percent alpha-olefin, preferably at least about 85 weight percent ethylene and less than about 15 weight percent alpha-olefin, more preferably at least about 90 weight percent ethylene and less than about 10 weight percent alpha-olefin.

[0085] Polyethylenes of such density may be heterogeneous or homogeneous, such as heterogeneous and homogeneous EAOs. As is known in the art, heterogeneous polymers have a relatively wide variation in molecular weight and composition distribution. Heterogeneous polymers may be prepared with, for example, conventional Ziegler Natta catalysts. On the other hand, homogeneous polymers have relatively narrow molecular weight and composition distributions. For example, homogeneous EAOs are structurally different from heterogeneous EAOs in that homogeneous EAOs exhibit: i) a relatively even sequencing of comonomers within a chain, ii) a mirroring of sequence distribution in all chains, and iii) a similarity of length of all chains (i.e., a narrower molecular weight distribution). Furthermore, homogeneous EAOs are typically prepared using metallocene, or other single-site type catalysts, rather than using Ziegler Natta catalysts. Single-site catalysts typically have only one type of catalytic site, which is believed to be the basis for the homogeneity of the polymers resulting from the polymerization. Homogeneous EAOs have molecular weight distributions, expressed as Mw/Mn, of less than about 4, preferably less than about 3, still more preferably less than 2.5, most preferably less than about 2.0. Homogeneous EAOs include long chain branched, linear, and bimodal composition, such as interpenetrating networks (IPN) resins. Homogeneous EAOs may be prepared by solution (preferred), gas phase, supercritical fluid phase, or slurry polymerization. IPNs may be prepared using tandem or mixed catalyst processes.

[0086] The substrate has a thickness, strength, and Young's modulus effective for the desired application. Useful substrate thicknesses, strengths, and Young's moduli include those as discussed above in conjunction with the peelable film.

[0087] The substrate 14 may be formed by one or more of any of a variety of processes known in the art, including extrusion (e.g., blown-film extrusion, coextrusion, extrusion coating, free film extrusion, and lamination), casting, adhesive lamination, injection molding, compression molding, transfer molding, blow molding, and thermoforming.

Peelably Sealed Packaging

[0088] The peelably sealed packaging 10, 50 may be formed by sealing the peelable film 12 to the substrate 14, for example, in the perimeter flange 34 area to enclose an article 8 (e.g., a food item) between the peelable film and the substrate. In doing so, the peelable layer 16 and substrate surface layer 36 may be placed opposite each other and subsequently fused together (FIGS. 4-5, 7) under effective heat sealing conditions—namely, a given heat seal temperature (i.e., heat seal bar or platen temperature), a given heat seal pressure, and a given dwell time effective to form a peelable seal 38, as is known in the art. The peelable seal 38 may form a hermetic seal between the peelable film and the substrate. This may be desirable where the packaged article

8 is a food item, the hermetic peel seal enhancing the protection provided by the peelably sealed packaging. Useful heat sealing conditions include heat seal pressure ranges of from about 30 to about 100 psig and from about 40 to about 80 psig. Useful temperature ranges include, from about 100° C. to about 160° C. and from about 120° C. to about 150° C. Useful dwell times include from about 0.3 to about 5 seconds, from about 0.5 seconds to about 3 seconds, and from about 0.5 to about 2 seconds. If a delamination peelable film 26 is sealed to a substrate 14 (FIG. 8-9), then delamination film layer 24 itself—or one or more additional layers 23—may be sealed to the substrate 14 to create a bond strength greater than that of the interlayer bond strength between peelable layer 16 and the delamination film layer 24 of the peelable film 12.

[0089] The minimum heat seal temperature generally effective for heat sealing the peelable layer 16 to a substrate surface layer 36 comprising a polyethylene having a density of from about 0.915 to about 0.93 g/cc to is from about 115° C. to about 120° C.—depending upon the heat seal conditions—because of the melting point and heat seal initiation temperature of the polyethylene. Lower heat seal temperatures, such as about 100° C., may generally be effective for forming a peelable seal where peelable layer 16 comprises ionomer. In general, the desired heat seal temperature ranges from about 120° C. to about 160° C.

Peel Strength

[0090] The bond or peel strength of the peelable seal preferably is sufficiently high to withstand the expected use conditions without prematurely failing; yet the bond strength is preferably sufficiently low to achieve an easy open characteristic. The term "peel strength" used in referring to the peel strength of peelable seal 38 is the amount of force required to separate the peelable layer 16 from substrate 14, either by pulling peelable film 12 from substrate 14 or by delaminating peelable film 12 into two portions, as measured in accordance with ASTM F88-94 where the Instron tensile tester crosshead speed is 5 inches per second, using five, 1-inch wide, representative samples. (The term "peel strength" is used in the sense of the maximum peel force required for each sample peel, averaged for five representative samples.) ASTM F88-94 is incorporated herein in its entirety by reference.

[0091] The term "peelably sealed" is used to describe the strength of a peelable seal between peelable film 12 and substrate 14 such that the peel or bond strength of the peelable seal 38 formed between the peelable layer 16 and the substrate surface layer 36 is within the range of from about 0.5 pounds per inch width (lb/in) to about 4.5 lb/in in order to facilitate an easy open characteristic. Other useful peelably sealed peel strengths include from about 1 to about 4.5 lb/in, from about 1.5 to about 4.5 lb/in, from about 2 to about 4.5 lb/in, from about 0.5 to about 4 lb/in, from about 0.5 to about 3 lb/in, from about 0.5 to about 2.5 lb/in, from about 0.5 to about 2 lb/in, from about 1 to about 3 lb/in, from about 0.7 to about 2 lb/in, and from about 1 to about 2.5 lb/in.

[0092] The term "peelably adhered" is used to describe the strength of the inter-layer adhesion of peelable layer 16 to delamination film layer 24 of the delamination peelable film 26 such that the peel or bond strength of the peelable seal 38

formed between the layers is within the range of from about 0.5 lb/in to about 4.5 lb/in to facilitate an easy open characteristic. (FIGS. 8-9.) Other useful peelably adhered peel strengths are the same as those set forth above with respect to the peelably sealed peel strengths.

[0093] Preferably, the peel strength is essentially equivalent (i.e., within about 0.5 lb/in, more preferably within about 0.3 lb/in) for the resulting peelable seal of a given thickness of peelable film 12 to a given thickness of substrate 14 for a given effective heat seal condition (i.e., a temperature within the range of from about 120° C. to about 160° C., a pressure, and a dwell time as discussed above), regardless of whether the substrate surface layer 36 is polyethylene having a density of from about 0.915 to about 0.93 g/cc (e.g., consists of a polyethylene having a density of from about 0.915 to about 0.93 g/cc) or is ionomer (e.g., consists of an ionomer copolymer of ethylene and (meth) acrylic acid having at least about 80 weight % ethylene content wherein from about 15% to about 60% of the (meth)acrylic acid groups are neutralized by sodium metal ion). Such essentially equivalent resulting peelable seal peel strengths allow a packager to change the type of substrate for an easy open package without having to significantly change either: 1) the peelable film used to seal the substrate to form the easy open package or 2) the heat seal conditions under which the peelable seal is made.

[0094] Preferably, the peel strength of the peelable seal gradually increases as the heat seal temperature (i.e., the temperature of the heat seal bar or platen) increases. This is useful for at least two reasons. First, the packager is then able to increase the peel strength merely by increasing the heat seal temperature. Second, the packager does not have to monitor the sealing temperature so closely. Otherwise, a relatively small drift or variation in the sealing temperature that may be associated with the sealing equipment may cause a large variation in the peel strength of the peelable seal. Of course, if the heat seal temperature is too high, then an unacceptably high bond strength may occur, such that the seal is not easily hand peelable. "Gradual increases" as used herein means peel strength increases ranging from about 0.2 to about 0.8 lb/in, and preferably from about 0.3 to about 0.6 lb/in, for each 20° F. (11.1° C.) increase in heat seal temperature within the heat seal temperature range of from 120 to 160° C.

[0095] Preferably, the peel strength of the peelable seal 38 to a substrate 14—where the substrate surface layer is either polyethylene having a density of from about 0.915 to about 0.93 g/cc or ionomer—is essentially independent of the peelable layer thickness (within a peelable layer thickness of from about 0.05 mil to about 1.25 mil, preferably from about 0.25 to about 1 mil). Also preferably, the peel strength of the peelable seal to a substrate—where the substrate surface layer is either polyethylene having a density of from about 0.915 to about 0.93 g/cc or ionomer—is essentially independent of the peelable film thickness (within a peelable film thickness of from about 1 mil to about 5 mil). In this context, "essentially independent" means that the peel strength does not vary more than about 0.5 lb/in for varied thicknesses, preferably does not vary more than about 0.3 lb/in.

[0096] Preferably, the peel strength of the peelable seal to a substrate where the substrate surface layer is either ionomer or polyethylene having a density of from about 0.915 to

about 0.93 g/cc ionomer is essentially stable over a 3 month period, preferably over a 7 month period. In this context, "essentially stable" means that the seal strength does not vary more than 0.5 lb/in from the initial peel strength measurement, preferably no more than about 0.3 lb/in.

[0097] Where the peelable film is multilayered (i.e., multilayer peelable film 20 or delamination peelable film 26), the peel strength between the peelable layer 16 and the adjacent layer 22 is preferably greater than the peel strength between the peelable layer 16 and the surface layer 36 (FIGS. 5, 7) or the peel strength between the peelable layer 16 and the delamination layer 24 (FIGS. 8-9).

Operation of the Peelably Sealed Packaging

[0098] To open peelably sealed packaging 10, the consumer simply grasps a portion (e.g., tab 40) of the peelable film 12 and pulls or "peels" it away from the substrate 14—thereby causing the peelable seal 38 to "fail" and the peelable film 12 to separate from the substrate 14. (FIGS. 1-4.) Likewise, to open peelably sealed rigid tray 50 (FIG. 6), the consumer grasps a portion of peelable film 12 and peels it away from rigid tray 32.

[0099] In opening the peelably sealed package, the type of failure for the peelable seal 38 depends on the design and location of the peelable layer 16. If the peelable layer 16 is an inside heat seal layer (FIGS. 5, 7) of the peelable film, then the resulting peel from the substrate 14 is an "interfacial peel" or "surface peel" in which the bond between the peelable layer 16 and the substrate 14 to which it was adhered fails adhesively.

[0100] If the peelable layer 16 is an internal layer of the peelable film 20 (FIGS. 8-10), then as the peelable layer is peeled, the peelable film delaminates, so that the delamination peelable film 26 separates between the peelable layer 16 and the delamination layer 24. In so doing, the delamination peelable film 26 may be designed to fail adhesively across its extent, so that the peelable film separates without breaking or tearing the delamination layer 24, which may remain adhered to the substrate 14 (FIG. 9). (In this design, the packaged object 8 may not be available for removal without later removing the remaining film portion adhered to the substrate.) Alternatively, the delamination peelable film 26 may be designed upon peeling to initially fail adhesively between the peelable layer 16 and the delamination layer 24, then once the peel or separation reaches the inside extent of perimeter flange 34, to fail cohesively by tearing through layers 24 and/or 23 (FIG. 10) to allow packaged object 8 to be retrieved from the packaging.

[0101] In opening peelably sealed packaging 10 or 50, regardless of the mechanism of the peelable seal failure, preferably the failure will not leave or cause "angel hair" or strings of resin to form between the separated layers or between the peeled film and the substrate.

EXAMPLES

[0102] The following examples are presented for the purpose of further illustrating and explaining the present invention and are not to be taken as limiting in any regard. Unless otherwise indicated, all parts and percentages are by weight.

Components of the Examples

[0103] ADH=a polyurethane adhesive.

[0104] EAO=a ethylene/octene copolymer with a melt index of 1.0 g/10 min and a density of 0.9038 g/cc (ASTM D792).

[0105] EMAA1=ethylene/methacrylic acid copolymer having 9% methacrylic acid content and a melt flow index of 2.5 grams/10 minutes.

[0106] EMAA2=ethylene/methacrylic acid copolymer having 4% methacrylic acid content and a melt flow index of 3 grams/10 minutes.

[0107] EPC1=a ethylene propylene random copolymer with a melt flow index of 2.1 g/10 min and a density of 0.900 g/cc (ASTM D1505).

[0108] EPC2=a ethylene propylene random copolymer with a melt flow index of 5.0 to 7.0 g/10 min and a density of 0.902 g/cc.

[0109] EVA1=ethylene/vinyl acetate copolymer having 12% vinyl acetate and a melt flow index of 2.5 grams/10 minutes.

[0110] EVA2=ethylene/vinyl acetate copolymer having 12% vinyl acetate and a melt flow index of 8 grams/10 minutes.

[0111] EVA3=ethylene/vinyl acetate copolymer having 6% vinyl acetate and a melt flow index of 2.6 grams/10 minutes.

[0112] EVA4=ethylene/vinyl acetate copolymer having 18% vinyl acetate and a melt flow index of 8 grams/10 minutes.

[0113] EVOH=a ethylene/vinyl alcohol copolymer having 38 mole % ethylene content.

[0114] HIPS=high impact polystyrene.

[0115] ION1=ionomer (sodium salt of ethylene/methacrylic acid copolymer having 15% methacrylic acid with about 59% of the acid groups neutralized) having a melt flow index of 0.9 grams/10 minutes.

[0116] ION2=ionomer (zinc salt of ethylene/methacrylic acid copolymer having 12% methacrylic acid with about 38% of the acid groups neutralized) having a melt flow index of 1.8 grams/10 minutes, available from E. I. du Pont de Nemours and Company (Wilmington, Del.) under the trademark SURLYN 1650.

[0117] ION3=ionomer (zinc salt of ethylene/methacrylic acid copolymer having 8.7% methacrylic acid with about 18% of the acid groups neutralized) having a melt flow index of 5.2 grams/10 minutes.

[0118] ION4=ionomer (zinc salt of ethylene/methacrylic acid copolymer having 12% methacrylic acid at least partially neutralized) having a melt flow index of 1.55 grams/10 minutes and a density of 0.950 g/cc, available from E. I. du Pont de Nemours and Company (Wilmington, Del.) under the trademark SURLYN 1650 SB (having the same neutralization as ION2, but also containing slip additive and silica as antiblock).

[0119] LDPE=a low density polyethylene with a melt index of 7.5 g/min and a density of 0.917 g/cc.

[0120] MB1=a nylon 6 with talc (magnesium silicate), calcium carbonate, and n, n'-ethylene bis stearamide.

[0121] MB2=a nylon 6 with diatomaceous earth and crucamide.

[0122] PA1=a nylon 6 resin having a density of 1.135 g/cc.

[0123] PA2=a amorphous nylon with a density of 1.18 g/cc.

[0124] PA3=a nylon 6 resin having a density of 1.14 g/cc.

[0125] PA4=a nylon 6 resin having a density of 1.13 g/cc.

[0126] PB1=a blend of about 92 weight % of PB 8640 (see PB3 below) with about 8 weight % LDPE, the composition having a melt flow index of 1.0 gram/10 minutes and a density of 0.915 g/cm³, available from Montell Polyolefins (now Basell) under the tradename PB 1600SA.

[0127] PB2=Polybutylene copolymer of butene-1 and ethylene, the copolymer having a melt index of 2.0 gram/10 minutes, a density of 0.908 g/cm³, and a melt point of 116° C., available from Montell Polyolefins (now Basell) under the tradename PB8240.

[0128] PB3=Polybutylene (polybutene-1) random copolymer of butene-1 and 1% ethylene having a melt flow index of 1.0 gram/10 minutes and a density of 0.908 g/cm³, available from Montell Polyolefins (now Basell) under the tradename PB8640.

[0129] PE1=a homogeneous ethylene/hexene-1 copolymer with a melt index of 4.5 g/10 min and a density of 0.917 g/cc available from Exxon Corporation (Houston, Tex.) under the trademark EXCEED 361C33.

[0130] PE2=a homogeneous ethylene/propylene copolymer with a melt index of 1.8 g/10 min and a density of 0.87 g/cc available from Mitsui Petrochemicals, Ltd. (Newark, N.J.) under the trademark TAFMER P-0480.

[0131] PET=a biaxially oriented, polyester (polyethylene terephthalate) film having an about 0.1 mil thick vinylidene chloride/methyl methacrylate copolymer layer on the inside surface.

[0132] PP1=polypropylene homopolymer having a melt flow index of 3.5 grams/10 minutes.

[0133] PP2=polypropylene homopolymer having a melt flow index of 12 grams/10 minutes.

[0134] PP3=polypropylene homopolymer having a melt flow index of 33 to 39 grams/10 minutes.

[0135] TIE1=a anhydride-grafted polyolefin resin having a density of 0.921 g/cc.

[0136] TIE2=a anhydride-grafted polyolefin having a density of 0.943 g/cc.

[0137] TIE3=a maleic anhydride-grafted polypropylene having a density of 0.900 g/cc.

[0138] Unless otherwise indicated, all melt flow indexes are measured according to ASTM D1238, at a temperature and piston weight as specified according to the material as set forth in the ASTM test method, and all densities are measured according to ASTM D1505. Each of ASTM D792, ASTM D1238, and ASTM D1505 is incorporated herein in its entirety by reference.

TABLE 1

	EVA1	EVA2	EVA3	PB1	PB2	ION1	ION2	ION3	EMAA1	EMAA2	PP1	PE2	HPS
Comparative 1	100%												
Comparative 2	50%			10%									
Comparative 3	80%			10%									20%
Comparative 4		100%											
Comparative 5				8%		5%			80%				
Comparative 6							60%						
Comparative 7		40%						100%					
Comparative 8											10%		
Comparative 9	90%											5%	
Comparative 10	50%		35%										
Comparative 11		75%			20%								
Comparative 12				5%					95%	100%			
Comparative 13													
Comparative 14		20%					80%						
Comparative 15		70%					75%						
Example 1		40%		5%			50%						
Example 2		20%		5%			75%						

EXAMPLES 1-2

[0139] Each of the films identified in Table 1 was made by the blown film method to form a monolayer film. Each film was prepared using a 1.5 inch Davis Standard extruder, equipped with a general purpose screw, feeding a 2-inch Killion die with a gap of 0.015 inches. A screen pack combination of 40 mesh/80 mesh/40 mesh was used. The system is fitted with an adjustable collapsing frame and the tower height was set at 30 inches. The screw speed was generally maintained between 20 to 30 revolutions per minute. Haul off speed was maintained at 16 to 17 lineal feet per minute. Film thickness was targeted at 2.0 mils.

[0140] Temperature profiles for the extruder were set at: 300° F. in the rear section; 330° F. in the center rear section; 365° F. to 370° F. in the center front section, and 385° F. to 400° F. in the front section. Tackier films were run at the lower temperatures for handling convenience. Temperature profiles for the die were set at: 385° F. to 400° F. at the die bottom; 385° F. to 400° F. at the die center; 385° F. to 400°

F. at the top of the die. Tackier films were run at the lower temperature settings for handling convenience.

[0141] Each of the films of Table 1 were heat sealed to a 2.0 mil LLDPE substrate film and a 2.0 mil ionomer substrate film. The LLDPE substrate was produced from an ethylenecyclohexane copolymer available from the Dow Chemical Company (Midland, Mich.) under the trademark DOWLEX 2045. The ionomer substrate was produced from a zinc ionomer available from E. I. du Pont de Nemours and Company (Wilmington, Del.) under the trademark SURLYN 1650. Each heat seal sample was produced using a Sentinel Heat Sealer having a 1-inch wide bar, a dwell time of 0.5 seconds, and a bar pressure of 40 pounds per square inch to heat seal the film sample to the substrate sample. The peel strength of the seal between each resulting film and substrate seal specimens was measured on a 1-inch wide strip using an Instron tensile tester with a crosshead speed of 12 inches per minute. The maximum value of force measured was recorded as the peel strength. The results are shown in Table 2.

TABLE 2

		Peel Strength vs. Seal Temperature				
Heat Seal Temperature:		95° C. (203° F.)	104° C. (220° F.)	116° C. (240° F.)	138° C. (280° F.)	149° C. (300° F.)
Composite 1	LLDPE	25 g/in	434 g/in	858 g/in	1156 g/in	1239 g/in
	substrate	0.06 lb/in	0.96 lb/in	1.49 lb/in	2.55 lb/in	2.71 lb/in
	Ionomer	34 g/in	238 g/in	667 g/in	786 g/in	677 g/in
Composite 2	LLDPE	0.16 lb/in	0.52 lb/in	1.47 lb/in	1.74 lb/in	1.49 lb/in
	substrate	35 g/in	320 g/in	753 g/in	1075 g/in	970 g/in
	Ionomer	0.03 lb/in	0.73 lb/in	1.67 lb/in	2.38 lb/in	2.17 lb/in
Composite 3	LLDPE	51 g/in	277 g/in	510 g/in	550 g/in	510 g/in
	substrate	0.06 lb/in	0.51 lb/in	1.14 lb/in	1.21 lb/in	1.12 lb/in
	Ionomer	20 g/in	334 g/in	951 g/in	1035 g/in	1012 g/in
Composite 4	LLDPE	0.04 lb/in	0.74 lb/in	2.05 lb/in	2.28 lb/in	2.23 lb/in
	substrate	78 g/in	294 g/in	657 g/in	1045 g/in	994 g/in
	Ionomer	0.17 lb/in	0.85 lb/in	1.45 lb/in	2.38 lb/in	2.10 lb/in
Composite 5	LLDPE	196 g/in	525 g/in	770 g/in	1012 g/in	1197 g/in
	substrate	0.43 lb/in	1.16 lb/in	1.70 lb/in	2.23 lb/in	2.44 lb/in
	Ionomer	95 g/in	363 g/in	607 g/in	729 g/in	781 g/in
Composite 6	LLDPE	0.21 lb/in	0.79 lb/in	1.52 lb/in	1.81 lb/in	1.72 lb/in
	substrate	47 g/in	300 g/in	607 g/in	729 g/in	781 g/in
	Ionomer	0.21 lb/in	0.79 lb/in	1.52 lb/in	1.81 lb/in	1.72 lb/in

TABLE 2-continued

		Peel Strength vs. Seal Temperature				
Heat Seal Temperature:		93 °C (201° F.)	104° C. (220° F.)	116° C. (240° F.)	131 °C. (268° F.)	149 °C. (300° F.)
Compare 5	LLDPE	11 g/in	89 g/in	607 g/in	1725 g/in	1238 g/in
	Ionomer	0.02 lb/in	0.13 lb/in	1.38 lb/in	2.88 lb/in	1.73 lb/in
Compare 6	LLDPE	7.90 g/in	974 g/in	1624 g/in	1694 g/in	1815 g/in
	Ionomer	0.33 lb/in	2.15 lb/in	3.58 lb/in	3.73 lb/in	4.09 lb/in
Compare 7	LLDPE	11 g/in	11 g/in	12 g/in	120 g/in	140 g/in
	Ionomer	0.03 lb/in	0.02 lb/in	0.03 lb/in	0.26 lb/in	0.33 lb/in
Compare 8	LLDPE	82 g/in	436 g/in	581 g/in	695 g/in	660 g/in
	Ionomer	0.18 lb/in	0.96 lb/in	1.28 lb/in	1.53 lb/in	1.47 lb/in
Compare 9	LLDPE	14 g/in	86 g/in	350 g/in	733 g/in	896 g/in
	Ionomer	0.03 lb/in	0.19 lb/in	0.77 lb/in	1.61 lb/in	1.91 lb/in
Compare 10	LLDPE	10 g/in	146 g/in	364 g/in	478 g/in	417 g/in
	Ionomer	0.27 lb/in	0.31 lb/in	0.80 lb/in	0.96 lb/in	0.92 lb/in
Compare 11	LLDPE	15 g/in	24 g/in	268 g/in	1462 g/in	1713 g/in
	Ionomer	0.33 lb/in	0.05 lb/in	0.59 lb/in	3.22 lb/in	3.77 lb/in
Compare 12	LLDPE	118 g/in	836 g/in	1759 g/in	1522 g/in	1930 g/in
	Ionomer	0.26 lb/in	1.85 lb/in	3.87 lb/in	4.23 lb/in	4.25 lb/in
Compare 13	LLDPE	23 g/in	463 g/in	571 g/in	1265 g/in	1343 g/in
	Ionomer	0.15 lb/in	1.02 lb/in	1.92 lb/in	2.79 lb/in	2.96 lb/in
Compare 14	LLDPE	52 g/in	282 g/in	691 g/in	725 g/in	803 g/in
	Ionomer	0.18 lb/in	0.62 lb/in	1.52 lb/in	1.60 lb/in	1.77 lb/in
Compare 15	LLDPE	13 g/in	54 g/in	451 g/in	1390 g/in	1291 g/in
	Ionomer	0.03 lb/in	0.21 lb/in	0.99 lb/in	3.06 lb/in	2.84 lb/in
Compare 16	LLDPE	44 g/in	285 g/in	460 g/in	553 g/in	581 g/in
	Ionomer	0.10 lb/in	0.63 lb/in	1.01 lb/in	1.22 lb/in	1.28 lb/in
Compare 17	LLDPE	20 g/in	275 g/in	580 g/in	1056 g/in	1660 g/in
	Ionomer	0.04 lb/in	0.61 lb/in	1.30 lb/in	2.33 lb/in	2.40 lb/in
Compare 18	LLDPE	89 g/in	278 g/in	338 g/in	444 g/in	447 g/in
	Ionomer	0.20 lb/in	0.61 lb/in	0.83 lb/in	0.98 lb/in	0.98 lb/in
Compare 19	LLDPE	15 g/in	17 g/in	410 g/in	1386 g/in	1517 g/in
	Ionomer	0.03 lb/in	0.04 lb/in	0.90 lb/in	2.94 lb/in	3.24 lb/in
Compare 20	LLDPE	12 g/in	128 g/in	997 g/in	1420 g/in	1496 g/in
	Ionomer	0.03 lb/in	0.28 lb/in	2.06 lb/in	3.15 lb/in	3.30 lb/in
Compare 21	LLDPE	12 g/in	27 g/in	382 g/in	1270 g/in	1276 g/in
	Ionomer	0.03 lb/in	0.08 lb/in	0.84 lb/in	2.80 lb/in	3.81 lb/in
Compare 22	LLDPE	251 g/in	819 g/in	1414 g/in	1533 g/in	1961 g/in
	Ionomer	0.33 lb/in	1.78 lb/in	3.11 lb/in	3.38 lb/in	3.44 lb/in
Compare 23	LLDPE	12 g/in	33 g/in	74 g/in	340 g/in	641 g/in
	Ionomer	0.03 lb/in	0.07 lb/in	0.07 lb/in	0.75 lb/in	1.41 lb/in
Compare 24	LLDPE	89 g/in	159 g/in	188 g/in	221 g/in	279 g/in
	Ionomer	0.20 lb/in	0.35 lb/in	0.41 lb/in	0.49 lb/in	0.61 lb/in
Compare 25	LLDPE	14 g/in	21 g/in	46 g/in	772 g/in	669 g/in
	Ionomer	0.03 lb/in	0.08 lb/in	0.10 lb/in	0.60 lb/in	1.03 lb/in
Example 1	LLDPE	77 g/in	230 g/in	388 g/in	540 g/in	586 g/in
	Ionomer	0.06 lb/in	0.52 lb/in	0.85 lb/in	1.16 lb/in	1.19 lb/in
Example 2	LLDPE	22 g/in	187 g/in	564 g/in	1040 g/in	855 g/in
	Ionomer	0.05 lb/in	0.41 lb/in	1.27 lb/in	2.29 lb/in	1.89 lb/in
Example 3	LLDPE	42 g/in	207 g/in	580 g/in	826 g/in	713 g/in
	Ionomer	0.09 lb/in	0.46 lb/in	1.28 lb/in	1.81 lb/in	1.56 lb/in
Example 4	LLDPE	12 g/in	37 g/in	110 g/in	460 g/in	504 g/in
	Ionomer	0.03 lb/in	0.08 lb/in	0.24 lb/in	1.08 lb/in	1.14 lb/in
Example 5	LLDPE	63 g/in	246 g/in	341 g/in	491 g/in	556 g/in
	Ionomer	0.09 lb/in	0.55 lb/in	0.75 lb/in	1.08 lb/in	1.01 lb/in

[0142] The peel strength of the peelable seals formed by Examples 1 and 2 with the LLDPE substrate (having a polyethylene surface layer) and the ionomer substrate (having an ionomer surface layer) were "essentially equivalent" (as that term is discussed in the "Peel Strength" section above).

Substrate Webs

[0143] The following substrate webs (Ionomer Substrate Webs 1-2 and PE Substrate Webs 1-2) were formed by the annular cast film extrusion method so that each final substrate web had the thickness and layers shown below:

Layer Composition (Weight %)		Percent of total substrate web thickness
Ionomer Substrate Web 1 (5 mil total thickness)		
Layer 1	PA3 (96%), MB1 (2%), MB2 (2%)	13%
Layer 2	HE2 (100%)	25%
Layer 3	PA1 (90%), PA2 (20%)	7%
Layer 4	PEOH (100%)	8%
Layer 5	PA1 (80%), PA2 (20%)	8%
Layer 6	HE1 (100%)	8%

-continued

Layer Composition (Weight %)	Percent of total substrate web thickness
Layer 7 Layer 8 (substrate surface layer)	25% 8%
Ionomer Substrate Web 2 (4 mil total thickness)	
Layers 1-6 Same as layers 1-6 of Ionomer Substrate Web 1	Same as layers 1-6 of Ionomer Substrate Web 1
PE Substrate Web 1 (5 mil total thickness)	
Layers 1-6 Same as Layers 1-6 as in Ionomer Substrate Web above	Same as Layers 1-6 in Ionomer Substrate Web above
Layer 7 Layer 8 (substrate surface layer)	25% 8%
PE Substrate Web 2 (3.5 mil total thickness)	
Layer 1 Layer 2 Layer 3 Layer 4 Layer 5 Layer 6 Layer 7 Layer 8 (substrate surface layer)	10% 14% 7% 13% 10% 13% 8% 25%

EXAMPLES 3-8

[0144] Peelable films of the present invention were made as laminates having the following layers:

Example 3 (Peelable film, laminate) (2.66 mil total thickness)

[0145]

Layer Composition (Weight %)	Layer thickness:
Layer 1 Layer 2 Layer 3 Layer 4 Layer 5 (peelable layer, heat seal layer)	0.56 mil 0.1 mil 3 mil 0.5 mil 0.5 mil

Example 4 (Peelable film, laminate) (3.66 mil total thickness)

[0146]

Layer Composition (Weight %)	Layer thickness:
Layer 1 Layer 2 Layer 3 Layer 4 Layer 5 (peelable layer, heat seal layer)	0.56 mil 0.1 mil 3.8 mil 0.75 mil 0.75 mil

Example 5 (Peelable film, laminate) (2.66 mil total thickness)

[0147]

Layer Composition (Weight %)	Layer thickness:
Layer 1 Layer 2 Layer 3 Layer 4 Layer 5 (peelable layer, heat seal layer)	0.56 mil 0.1 mil 3 mil 0.5 mil 0.5 mil

Example 6 (Peelable film, laminate) (3.66 mil total thickness)

[0148]

Layer Composition (Weight %)	Layer thickness:
Layer 1 Layer 2 Layer 3 Layer 4 Layer 5 (peelable layer, heat seal layer)	0.56 mil 0.1 mil 1.5 mil 0.75 mil 0.75 mil

Example 7 (Peelable film laminate) (2.66 mil total thickness)

[0149]

Layer Composition (Weight %)	Layer thickness:
Layer 1 Layer 2 Layer 3 Layer 4 Layer 5 (peelable layer, heat seal layer)	0.56 mil 0.1 mil 3 mil 0.5 mil 0.5 mil

Example 8 (Peelable film, laminate) (2.66 mil total thickness)

[0150]

	Layer Composition (Weight %)	Layer thickness
Layer 1	PE1 (100%)	0.56 mil
Layer 2	ADH (100%)	0.1 mil
Layer 3	EPCL (80%), EAO (20%)	1 mil
Layer 4	EAO (100%)	0.5 mil
Layer 5	ION2 (98%), EVA2 (30%), PB3 (5%)	0.5 mil
(peelable layer, base seal layer)		

(Note: Examples 3 and 8 have the same composition, but were made at different times.)

[0151] Layers 3-5 were formed by blown-film extrusion, then layer 3 was adhesively laminated to layer 1 to form the five-layer peelable film (laminate).

[0152] Layer 5 of each of the peelable films of Examples 3 and 4—and also of Example 3 film aged seven months at room temperature—was sealed to the Layer 8 of the Ionomer Substrate Web 1 or the PE Substrate Web 1 using a Sencorp Heat Sealer model 12AS/1. This Sencorp Heat Sealer is a bar heat sealer useful in forming test specimens. This Sencorp Heat Sealer used a heated upper bar or jaw and an unheated lower bar. The Sencorp Heat Sealer operated having the heat seal temperature shown in Table 3 (i.e., upper heat seal temperature) for a dwell time of 2 seconds and a seal bar closing pressure of 80 psig. Five representative 1-inch wide strips were cut from each heat-sealed packaging specimen. The peel strength for each of these 5 samples was measured according to ASTM F88-94 where the Instron tensile tester crosshead speed is 5 inches per second. The maximum peel force required for each sample peel was averaged for the five representative samples and the number reported as the peel strength below in Table 3. None of the peelably-sealed packaging samples exhibited angel hair or stringers as the peelable film was peeled from the substrate.

TABLE 3

		Peel Strength (lb/in) vs. Seal Temperature						
Heat Seal Temperature								
Peelable film	Substrate	100° C.	110° C.	120° C.	130° C.	140° C.	150° C.	160° C.
Ex 3	PE Web 1	0.31	1.03	1.31	1.43	1.58	1.86	1.98
	Ionomer Web 1	0.73	0.96	1.22	1.45	1.61	1.83	1.77
Ex 3 (aged 7 months)	PE Web 1	0.24	0.88	1.28	1.46	1.40	1.90	1.99
	Ionomer Web 1	0.57	0.80	1.11	1.28	1.54	1.93	1.88
Ex 4	PE Web 1	0.22	1.01	1.37	1.46	1.91	1.78	1.91
	Ionomer Web 1	0.66	0.90	1.05	1.19	1.47	1.66	1.65

[0153] Examples 3 and 4 had an average haze (as measured against layer 1) of 13% and 12%, respectively.

[0154] The results in Table 3 show that the peel strengths for the peelable film Example 3 where the peelable film was aged over seven months are essentially stable relative to the non-aged counterpart because the peel strength changes over this time were all less than 0.28 lb/in (i.e., 1.68 lb/in minus 1.40 lb/in).

[0155] The results in Table 3 also show that the peel strengths for Example 3 (having a peelable layer of 0.5 mils) and Example 4 (having a peelable layer of 0.75 mils) were essentially independent of the peelable layer thickness, because the peel strength differences were all less than 0.26 lb/in (1.45 lb/in minus 1.19 lb/in). This maximum 0.26 lb/in difference also indicates that the peel strengths for Example 3 (having a peelable film thickness of 2.66 mils) and Example 4 (having a peelable film thickness of 3.66 mils) were also essentially independent of the peelable film thickness.

[0156] Table 3 also indicates that the peel strengths of the peelable seal formed between Examples 3 or 4 with either the PE Substrate Web 1 (having a polyethylene surface layer) or the Ionomer Substrate Web 1 (having an ionomer surface layer) were essentially equivalent, because the largest peel strength difference at a given heat seal temperature in the range of 120° C. to 160° C. was 0.27 lb/in (i.e., 1.46 lb/in minus 1.19 lb/in).

[0157] Layer 5 of each of the peelable films of Examples 5-8 was sealed to the Layer 8 of the Ionomer Substrate Web 2 or the PE Substrate Web 2 using a Multivac Packaging Equipment Company Model R7000 Horizontal Pouch-Fill-Seal (HFFS) machine operating without vacuum. The HFFS sealer operated with an upper seal bar or platen at the heat seal temperature shown in Table 4 for a dwell time of 2 seconds and a seal bar closing pressure of 80 psig. (The bottom platen is not heated.) Five representative 1-inch wide strips were cut from each heat-sealed packaging specimen. The peel strength for each of these 5 samples was measured according to ASTM F88-94 where the Instron tensile tester crosshead speed is 5 inches per second. The maximum peel force required for each sample peel was averaged for the five representative samples and the number reported as the peel strength below in Table 4. None of the peelably-sealed

packaging samples exhibited angel hair or stringers as the peelable film was peeled from the substrate.

TABLE 4

Peel Strength (lb/in) vs. Seal Temperature				
Heat Seal Temperature				
Peel-able film	Substrate	103° C.	125° C.	150° C.
Ex 5	PE Web 2	0.37	1.22	2.12
	Ionomer	0.95	1.57	1.81
	Web 2			
Ex 6	PE Web 2	0.41	1.31	1.84
	Ionomer	0.5	1.35	1.82
	Web 2			
Ex 7	PE Web 2	0.63	1.32	2.30
	Ionomer	0.87	1.56	2.10
	Web 2			
Ex 8	PE Web 2	0.52	1.13	1.76
	Ionomer	0.73	1.59	1.80
	Web 2			

[0158] Examples 5-8 had an average haze (as measured against layer 1) of 21%, 23%, 42%, and 14%, respectively.

[0159] The results in Table 4 show that the peel strengths for Example 5 (having a peelable layer of 0.5 mils) and Example 6 (having a peelable layer of 0.75 mils) were essentially independent of the peelable layer thickness, because the peel strength differences were all less than 0.48 lb/in (2.12 lb/in minus 1.64 lb/in). This maximum 0.48 lb/in difference also indicates that the peel strengths for Example 5 (having a peelable film thickness of 2.66) and Example 6 (having a peelable film thickness of 3.66) were also essentially independent of the peelable film thickness.

[0160] Table 4 also indicates that the peel strengths of the peelable seal formed between Examples 5, 6, 7, or 8 with either the PE Substrate Web 2 (having a polyethylene surface layer) or the Ionomer Substrate Web 2 (having an ionomer surface layer) were essentially equivalent, because the largest peel strength difference at a given heat seal temperature in the range of 120° C. to 160° C. was 0.46 lb/in (i.e., 1.59 lb/in minus 1.13 lb/in).

EXAMPLES 9-11

[0161] The following peelable films of the present invention were made as cast extruded films having the following layers:

Example 9 (Peelable Film) (3.5 mil total thickness)

[0162]

Layer Composition (Weight %)		Percent of total thickness
Layer 1	PA3 (96%), MB1 (2%), MB2 (2%)	8%
Layer 2	TH2 (100%)	31%
Layer 3	PA1 (80%), PA2 (20%)	9%
Layer 4	ESM9 (100%)	2%
Layer 5	PA1 (80%), PA2 (20%)	9%
Layer 6	TH3 (100%)	2%
Layer 7	PE1 (55%), LDPE (19%), PE2 (35%)	59%
Layer 8 (peelable layer)	ION2 (55%), EVA2 (35%), PB3 (10%)	8%

Example 10 (Peelable Film) (3.5 mil total thickness)

[0163]

Layer Composition (Weight %)	Percent of total thickness
Layers 1-7	Same as Layers 1-7 as in Ex AA
Layer 8 (peelable layer)	ION2 (60%), EVA2 (30%), PB3 (10%)

Example 11 (Peelable Film) (3.5 mil total thickness)

[0164]

Layer Composition (Weight %)	Percent of total thickness
Layers 1-7	Same as Layers 1-7 as in Ex AA
Layer 8 (peelable layer)	ION2 (60%), EVA2 (30%), PB3 (10%)

[0165] Layer 8 of each of the peelable films of Examples 9-11 was sealed to the Layer 8 of the Ionomer Substrate Web 1 or the PE Substrate Web 1 (described above) using the Multivac HFTS machine as described with respect to Examples 5-8 above to form samples under the same conditions and procedures as discussed there. The results were averaged for each sample type. The results are shown in Table 5. The resulting peel strength measurements are reported in Table 5.

TABLE 5

Peel Strength (lb/in) vs. Seal Temperature					
Heat Seal Temperature					
Peel-able film	Substrate	103° C.	125° C.	147° C.	160° C.
Ex 9	PE Web 1	0.38	1.64	2.15	2.48
	Ionomer	1.15	1.69	2.07	2.55
Ex 10	PE Web 1	0.04	1.88	2.31	2.05
	Ionomer	1.12	1.79	2.41	3.01
Ex 11	PE Web 1	<0.05	1.34*	2.29	2.24
	Ionomer	1.48	1.93	2.11	2.34

*It is suspected that the 120° C. seal bar temperature for these samples was not actually optimized (i.e., not properly equilibrated) resulting in no effective melting or softening of the polyethylenes and/or occurring at a below actual peel strength.

EXAMPLE 12

[0166] The following peelable film of the present invention was made as a coextruded cast film having the following layers:

Example 12 (Peelable Film) (4 mils in total thickness)

[0167]

	Layer Composition (Weight %)	Percent of total thickness
Layer 1	PA3 (66%), MB1 (2%), ME2 (2%)	8%
Layer 2	TR1 (100%)	31%
Layer 3	PA1 (66%), PA2 (20%)	9%
Layer 4	EVA4 (100%)	8%
Layer 5	PA1 (66%), PA2 (20%)	9%
Layer 6	TR1 (100%)	35%
Layer 7	PE1 (55%), LDPE (19%), PE2 (35%)	19%
Layer 8 (peelable layer)	ION2 (65%), EVA2 (91%), PR3 (5%)	9%

[0168] Layer 8 of the peelable film of Example 12 was scaled to Layer 8 of the Ionomer Substrate Web 2 or the PE Substrate Web 2 (described above) using the Multivac HFFS machine as described with respect to Examples 5-8 above to form samples under the same conditions and procedures as discussed there. The results were averaged for each sample type. The resulting peel strength measurements are reported in Table 6. None of the peelably-sealed packaging samples exhibited angel hair or stringers as the peelable film was peeled from the substrate.

TABLE 6

Peel Strength (lb/in.) vs. Seal Temperature		Heat Seal Temperature		
Peelable film	Substrate	200° C.	125° C.	150° C.
Ex 12	PE Web 2 Ionomer Web 2	0.31 (0.33)	2.86 2.46	3.39 3.40

[0169] Table 6 shows that the peel strengths of the peelable seal formed between Example 12 with either the PE Substrate Web 2 (having a polyethylene surface layer) or the Ionomer Substrate Web 2 (having an ionomer surface layer) were essentially equivalent, because the largest peel strength difference at a given heat seal temperature in the range of 125° C. to 150° C. was 0.20 lb/in. (i.e., 2.60 lb/in minus 2.40 lb/in).

[0170] The above descriptions are those of preferred embodiments of the invention. Various alterations and changes can be made without departing from the spirit and broader aspects of the invention as defined in the claims, which are to be interpreted in accordance with the principles of patent law, including the doctrine of equivalents. Except in the claims and the specific examples, or where otherwise expressly indicated, all numerical quantities in this description indicating amounts of material, reaction conditions, use conditions, molecular weights, and/or number of carbon atoms, and the like, are to be understood as modified by the word "about" in describing the broadest scope of the invention. Any reference to an item in the disclosure or to an element in the claim in the singular using the articles "a," "an," "the," or "said" is not to be construed as limiting the item or element to the singular unless expressly so stated. Unless otherwise indicated, all parts and percentages in this application are by weight.

What is claimed is:

1. A peelably sealed package, the package comprising: a web comprising a peelable layer comprising a blend of: from about 3 to about 15 weight parts polybutylene; from about 40 to about 75 weight parts ionomer; and from about 20 to about 55 weight parts ethylene/unsaturated ester copolymer wherein the unsaturated ester is selected from the group consisting of: vinyl esters of aliphatic carboxylic acids, where the vinyl esters have from 4 to 12 carbon atoms; and alkyl esters of acrylic or methacrylic acid, where the alkyl esters have from 4 to 12 carbon atoms; and

a substrate comprising a surface layer comprising a polymer selected from the group consisting of polyethylene having a density of from about 0.915 to about 0.93 g/cc, ionomer, and mixtures thereof, wherein the peelable layer of the web and the surface layer of the substrate are peelably sealed to each other in one or more selected areas.

2. The peelably sealed package of claim 1 wherein the peelable layer of the web and the surface layer of the substrate form a peelable seal having a peel strength of from about 0.5 to about 4.5 lb/in.
3. The peelably sealed package of claim 1 wherein the peelable layer of the web and the surface layer of the substrate form a peelable seal having a peel strength of from about 1 to about 4 lb/in.
4. The peelably sealed package of claim 1 wherein the peelable layer of the web and the surface layer of the substrate form a peelable seal having a peel strength of from about 1 to about 2.5 lb/in.
5. The peelably sealed package of claim 1 wherein the peelable layer of the web and the surface layer of the substrate form a peelable seal having a peel strength of from about 0.7 to about 2 lb/in.
6. The peelably sealed package of claim 1 wherein the peelable layer of the web and the surface layer of the substrate form a peelable seal that is capable of remaining essentially stable over a 3 month period.
7. The peelably sealed package of claim 1 wherein: the peelable layer of the web and the surface layer of the substrate form a peelable seal having a peel strength; the web further comprises a second layer adjacent the peelable layer and having a given peel strength between the peelable layer and the second layer, the second layer comprising a thermoplastic; and the peel strength between the peelable layer and the second layer is greater than the peel strength between the peelable layer and the surface layer.
8. The peelably sealed package of claim 1 wherein the peelable layer comprises from about 5 to about 12 parts polybutylene.
9. The peelably sealed package of claim 1 wherein the peelable layer comprises polybutylene having a comonomer content of less than about 4 weight %.
10. The peelably sealed package of claim 1 wherein the polybutylene is nonclastomeric.

11. The peelably sealed package of claim 1 wherein the peelable layer comprises from about 45 to about 70 parts ionomer.

12. The peelably sealed package of claim 1 wherein the ionomer of the peelable layer comprises a copolymer of ethylene and (meth)acrylic acid having at least about 80 weight % ethylene content wherein from about 15% to about 60% of the (meth)acrylic acid groups are neutralized by a metal ion selected from the group consisting of sodium, zinc, or combinations thereof.

13. The peelably sealed package of claim 1 wherein the peelable layer comprises from about 30 to 55 parts ethylene/unsaturated ester copolymer.

14. The peelably sealed package of claim 1 wherein the ethylene/unsaturated ester copolymer includes from about 6 to about 18 weight % unsaturated ester.

15. The peelably sealed package of claim 1 wherein the ethylene/unsaturated ester copolymer includes from about 8 to about 12 weight % unsaturated ester.

16. The peelably sealed package of claim 1 wherein the unsaturated ester is an alkyl ester of acrylic or methacrylic acid, where the alkyl ester has from 4 to 12 carbon atoms.

17. The peelably sealed package of claim 1 wherein the unsaturated ester is a vinyl ester of aliphatic carboxylic acid, where the vinyl ester has from 4 to 12 carbon atoms.

18. The peelably sealed package of claim 1 wherein the ethylene/unsaturated ester is an ethylene/vinyl acetate copolymer having from about 6 to about 18 weight % vinyl acetate content.

19. The peelably sealed package of claim 1 wherein the ethylene/unsaturated ester is an ethylene/alkyl (meth)acrylate copolymer having from about 6 to about 18 weight % alkyl (meth)acrylate content, the alkyl (meth)acrylate having from 4 to 6 carbon atoms.

20. The peelably sealed package of claim 1 wherein the peelable layer comprises from about 5 to about 12 parts polybutylene, from about 45 to about 70 parts ionomer, and from about 30 to about 55 parts ethylene/vinyl acetate copolymer.

21. The peelably sealed package of claim 1 wherein the substrate comprises a surface layer comprising at least about 80 weight % of a polyethylene having a density of from about 0.915 to about 0.93 g/cc.

22. The peelably sealed package of claim 1 wherein the substrate comprises a surface layer comprising at least about 80 weight % of an ionomer.

23. The peelably sealed package of claim 1 wherein the web has a thickness of no more than about 4 mils and haze of no more than about 30%.

24. The peelably sealed package of claim 1 further comprising an article enclosed between the web and substrate.

25. The peelably sealed package of claim 1 wherein the peelable layer of the web and the surface layer of the substrate form a hermetic peelable seal.

26. The peelably sealed package of claim 1 wherein the substrate is rigid.

27. The peelably sealed package of claim 1 wherein the substrate is flexible.

28. The peelably sealed package of claim 1 wherein the substrate has a Young's modulus of from about 70 to about 2000 MPa, measured at 100° C.

29. The peelably sealed package of claim 1 wherein the peelable film has a Young's modulus of from about 70 to about 2000 MPa, measured at 100° C.

30. A method of packaging comprising:

placing an article between the web and the substrate of claim 1; and

peelably sealing the peelable layer of the web to the surface layer of the substrate to enclose the article between the web and substrate.

31. A peelably sealed package, the package comprising:

a web having a Young's modulus of from about 70 to about 2000 MPa, measured at 100° C., a thickness of no more than about 4 mils, and a haze of no more than about 30%, the web comprising a peelable layer comprising a blend of:

from about 5 to about 12 weight parts nonelastomeric polybutylene having a comonomer content of less than about 4 weight %;

from about 45 to about 70 weight parts ionomer comprising a copolymer of ethylene and (meth)acrylic acid having at least about 80 weight % ethylene content wherein from about 15% to about 60% of the (meth)acrylic acid groups are neutralized by a metal ion selected from the group consisting of sodium, zinc, or combinations thereof; and

from about 30 to about 55 weight parts ethylene/vinyl acetate copolymer having from about 6 to about 18 weight % vinyl acetate content; and

a substrate comprising a surface layer comprising at least about 80 weight % of a polymer selected from the group consisting of polyethylene having a density of from about 0.915 to about 0.93 g/cc, ionomer, and mixtures thereof; and

an article enclosed between the web and substrate, wherein the peelable layer of the web and the surface layer of the substrate are peelably sealed to each other in one or more selected areas to form a hermetic peelable seal having a peel strength of from about 1 to about 4 lb/in.

32. A thermoplastic film comprising at least one layer comprising a blend of:

from about 3 to about 15 parts polybutylene;

from about 40 to about 75 parts ionomer; and

from about 20 to about 55 weight parts ethylene/unsaturated ester copolymer wherein the unsaturated ester is selected from the group consisting of vinyl esters of aliphatic carboxylic acids, where the vinyl esters have from 4 to 12 carbon atoms, and alkyl esters of acrylic or methacrylic acid, where the alkyl esters have from 4 to 12 carbon atoms.

33. The film of claim 32 wherein the at least one layer comprises from about 5 to about 12 parts polybutylene, from about 45 to about 70 parts ionomer, and from about 30 to 55 parts ethylene/unsaturated ester copolymer.

34. The film of claim 32 wherein the at least one layer comprises nonelastomeric polybutylene having a non-butylene comonomer content of less than about 4 weight %.

35. The film of claim 32 wherein the ionomer of the at least one layer comprises a copolymer of ethylene and

(meth)acrylic acid having at least about 80 weight % ethylene content wherein from about 15% to about 60% of the (meth)acrylic acid groups are neutralized by a metal ion selected from the group consisting of sodium, zinc, or combinations thereof.

36. The film of claim 32 wherein the ethylene/unsaturated ester copolymer includes from about 6 to about 18 weight % unsaturated ester.

37. The film of claim 32 wherein the ethylene/unsaturated ester copolymer includes from about 8 to about 12 weight % unsaturated ester.

38. The film of claim 32 wherein the unsaturated ester is an alkyl ester of acrylic or methacrylic acid, the alkyl ester having from 4 to 12 carbon atoms.

39. The film of claim 32 wherein the unsaturated ester is a vinyl ester of aliphatic carboxylic acid, the vinyl ester having from 4 to 12 carbon atoms.

40. The film of claim 32 wherein the ethylene/unsaturated ester is an ethylene/vinyl acetate copolymer having from about 6 to about 18 weight % vinyl acetate content.

41. The film of claim 32 wherein the ethylene/unsaturated ester is an ethylene/alkyl (meth)acrylate copolymer having from about 6 to about 18 weight % alkyl (meth)acrylate content, the alkyl (meth)acrylate having from 4 to 6 carbon atoms.

42. The film of claim 32 wherein the film is a monolayer film.

43. The film of claim 32 wherein the at least one layer is an outer layer of the film.

44. The film of claim 32 wherein the at least one layer is an internal layer of the film.

45. The film of claim 32 further comprising a second layer adjacent the at least one layer, the second layer comprising at least about 80 weight % of polymer selected from the group consisting of polyethylene having a density of from about 0.915 to about 0.93 g/cc, ionomer, and mixtures thereof.

46. The film of claim 32 wherein the at least one layer is an internal layer of the film.

47. The film of claim 32 further comprising a second layer adjacent the at least one layer, the second layer comprising polyethylene having a density of from about 0.915 to about 0.93 g/cc.

48. The film of claim 32 further comprising a second layer adjacent the at least one layer, the second layer comprising ionomer.

49. The film of claim 32 further comprising a second layer adjacent the at least one layer, the second layer comprising at least about 80 weight % of polymer selected from the group consisting of polyethylene having a density of from about 0.915 to about 0.93 g/cc, ionomer, and mixtures thereof wherein the at least one layer and the second layer are peelably adhered together to form a peelable seal.

50. The film of claim 49 wherein the peelable seal has a peel strength of from about 1 to about 4 lb/in.

51. The film of claim 49 wherein the peelable seal has a peel strength of from about 0.5 to about 3 lb/in.

52. The film of claim 49 wherein the peelable seal has a peel strength of from about 1 to about 2.5 lb/in.

53. The film of claim 49 wherein the peelable seal has a peel strength of from about 0.7 to about 2 lb/in.

54. The film of claim 49 further comprising a third layer adjacent the at least one layer, the third layer comprising a thermoplastic material and having a given peel strength between the at least one layer and the third layer, wherein the peel strength between the at least one layer and the third layer is greater than the peel strength between the at least one layer and the second layer.

55. The film of claim 32 wherein:

the at least one layer is capable of forming, under given heat seal conditions that include a given heat seal temperature of from 130° C. to 160° C., a first peelable seal having a peel strength with a polyethylene surface layer of a first substrate where the surface layer consists of a polyethylene having a density of from about 0.915 to about 0.93 g/cc and wherein the polyethylene surface layer has a given thickness and the first substrate has a given thickness;

the at least one layer is also capable of forming, under the given heat seal conditions that include the given heat seal temperature, a second peelable seal having a peel strength with an ionomer surface layer of a second substrate where the surface layer consists of an ionomer copolymer of ethylene and (meth)acrylic acid having at least about 80 weight % ethylene content wherein from about 15% to about 60% of the (meth)acrylic acid groups are neutralized by sodium metal ion and wherein the ionomer surface layer has the given surface layer thickness of the polyethylene surface layer and the second substrate has the given thickness of the first substrate; and

the peel strength of the first peelable seal is within about 0.5 lb/in of the peel strength of the second peelable seal.

56. The film of claim 32 wherein the peel strength of the first peelable seal is within about 0.5 lb/in of the peel strength of the second peelable seal.

57. The film of claim 32 wherein the film has a thickness of no more than about 4 mils and a haze of no more than about 30%.

58. The film of claim 32 wherein the film has a Young's modulus of from about 70 to about 2000 MPa, measured at 100° C.

* * * * *

**Evidence
Appendix B**

United States Patent [19]

Aversano

[11] **Patent Number:** 4,476,112

[45] **Date of Patent:** * Oct. 9, 1984

- [54] **FOOD PRESERVATIVE COMPOSITION**
 [75] **Inventor:** Ralph W. Aversano, Hamden, Conn.
 [73] **Assignee:** Stny Fresh, Inc., Boston, Mass.
 [*] **Notice:** The portion of the term of this patent subsequent to Nov. 22, 2000 has been disclaimed.
 [21] **Appl. No.:** 551,026
 [22] **Filed:** Nov. 14, 1983

Related U.S. Application Data

- [63] Continuation-in-part of Ser. No. 376,414, May 10, 1982, Pat. No. 4,416,909.
 [51] **Int. Cl.³** A01N 59/00; A23B 4/02; A23B 4/12; A23B 7/10; A23B 7/14
 [52] **U.S. Cl.** 424/127; 426/532; 426/652; 426/654
 [58] **Field of Search** 426/264, 265, 266, 268, 426/269, 281, 331, 332, 532, 641, 644, 646, 652, 654, 321; 252/400.1, 407, 400.61, 400.62; 424/127

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[57] **ABSTRACT**

This invention resides in a composition for treatment of meat, poultry, fruit and vegetables to maintain the color and to preserve same. The composition comprises as essential constituents between about 10 and 40% each of the following materials:

- (1) ascorbic acid and/or the sodium or potassium salts thereof;
- (2) citric acid and/or the sodium or potassium salts thereof;
- (3) sodium or potassium carbonate; and
- (4) sulfite, bisulfite or metabisulfite of sodium or potassium.

These materials represent a synergistic combination which preserves the color and freshness of these products for a surprisingly long period of time.

4 Claims, No Drawings

FOOD PRESERVATIVE COMPOSITION

CROSS-REFERENCE TO RELATED APPLICATION

This application is a Continuation-In-Part of copending application Ser. No. 376,414, filed May 10, 1982, now U.S. Pat. No. 4,416,909.

BACKGROUND OF THE INVENTION

This invention relates to a process and composition for treating edible products to maintain color and also to preserve the freshness thereof, for example, fish, meat, meat products and fruits and vegetables.

It is highly desirable to preserve the freshness and color of edible products. For example, myoglobin, hemoglobin and other like compounds found in meat are commonly believed to be responsible for the red and red-purple color of fresh meat. Upon exposure to air these compounds are oxidized to oxymyoglobin and oxymyoglobin which are bright red in color. Exposure to air over prolonged periods results in further oxidation to metmyoglobin and methemoglobin which are brown or grey in color and which detract from the appearance and saleability of the meat.

Conventional meat color preserving agents are known, such as ascorbic acid and/or nicotinic acid, which function by reacting with the myoglobin and hemoglobin either before or after they are oxidized to form a color which is relatively stable over longer periods of time. However, continued exposure to the air will cause a further oxidation reaction with a resultant undesirable change in the color of the meat product to brown or grey.

At the same time, it is well known that fresh meat products are susceptible to spoilage on storage. In order to keep fresh meat products from rapid spoilage, it is customary to keep them refrigerated so that the rate of bacterial growth is retarded.

It is naturally desirable to provide a composition which is effective to still further retard bacterial growth and maintain the freshness of edible products.

Accordingly, it is a principal object of the present invention to provide a composition which effectively treats edible products to maintain a desirable color.

It is a further object of the present invention to provide a composition as aforesaid which retards bacterial growth and maintains freshness.

It is a still further object of the present invention to provide a composition which is inexpensive, easy to apply and which is based on materials which may be safely used in edible products.

Further objects and advantages of the present invention will appear from the ensuing discussion.

SUMMARY OF THE INVENTION

In accordance with the present invention, it has been found that the composition of the present invention effectively achieves the foregoing objects and advantages in a simple, convenient and expeditious manner.

The composition of the present invention effectively treats edible products to maintain the desirable color thereof, to maintain freshness and to retard bacterial growth. The composition consists essentially of 10 to 40% of each of the following components:

(a) a material selected from the group consisting of ascorbic acid, the sodium and potassium salts thereof and mixtures thereof;

(b) a material selected from the group consisting of citric acid, the sodium and potassium salts thereof and mixtures thereof;

(c) a material selected from the group consisting of sodium carbonate, potassium carbonate and mixtures thereof; and

(d) a material selected from the group consisting of sodium and potassium sulfite, bisulfite and metabisulfite and mixtures thereof.

In accordance with the present invention a composition as aforesaid is applied to the edible product in an effective amount and is preferably applied to the product in an amount of from 1 ounce to 2 pounds per hundred pounds of product being treated.

DETAILED DESCRIPTION

The composition of the present invention may be effectively used in preserving the color and freshness of fresh meats and meat products and finds its greatest utility in this application; however, its use is not limited thereto and it may also be used to treat aged and cured meats, fish, fruits and vegetables. In accordance with the present invention, the product to be treated, such as cuts of meat or whole carcasses, may be treated by dusting the exposed surfaces with the composition of the present invention or by spraying the surfaces with a solution thereof. For carcasses, treatment may be accomplished by injecting a solution of the composition of the present invention into the arteries and veins. For ground meat, the treating materials may be applied to the exposed surface of the ground meat or added to the meat before or during grinding to permit distribution thereof throughout the ground mass. It is preferred in accordance with the present invention that the components thereof be thoroughly mixed together before application to the product.

In accordance with the present invention, the ascorbic acid component may be ascorbic acid itself and/or the sodium and/or potassium salts thereof. Similarly, the citric acid component may be the citric acid itself and/or the sodium and/or potassium salts thereof, i.e., sodium or potassium citrate.

Either sodium and/or potassium carbonate may be employed. The sulfite component may be a sulfite, bisulfite and/or metabisulfite of sodium and/or potassium.

The amounts of the components of the present invention are as stated hereinabove. Preferably, substantially equal quantities of each of the components are employed.

In accordance with a preferred embodiment of the present invention, a suitable quantity of ground meat is first ground and mixed with a suitable quantity of the composition of the present invention and the mixture reground. In accordance with an alternate embodiment for red meats, poultry, fish, fruits and vegetables, a suitable quantity of the composition of the present invention is dissolved in water and the edible meat product sprayed with the aqueous solution. Naturally, alternate methods of application of the composition of the present invention may be readily employed.

Naturally, additional freshness or color preservatives may, if desired, be added to the product such as nitrates or nitrites, phosphates, nicotinic acid or other known color or freshness preservatives. The surprising feature

of the composition of the present invention is the synergistic combination of the components thereof which effectively preserves color and freshness and retards bacterial growth for an inordinately long period of time far beyond what would normally be anticipated.

The foregoing will be more clearly apparent from the examples which form a part of the present specification.

EXAMPLE I

A composition of the present invention was formulated by mixing together equal amounts of sodium bisulfite, ascorbic acid, citric acid and sodium carbonate. Fifty pounds of fresh red hamburger was first ground and then thoroughly mixed with two ounces of the foregoing mixture. The mixture was then reground and stored in a refrigerated condition at a temperature of approximately 35° F. The resultant meat retained its bright red color and freshness for approximately two weeks. Untreated meat darkened after about one week and at the end of the two week period was quite dark and no longer fresh.

EXAMPLE II

Two ounces of the composition of Example I were thoroughly dissolved in two quarts of water. The composition was sprayed on various samples of poultry and red meats. The resultant sprayed samples were stored in a refrigerated condition as in Example I and maintained their color and freshness for approximately two weeks. Comparable materials lost their color after about one week and were no longer fresh after the two week period.

EXAMPLE III

A piece of veal which had started to discolor was tested in a variety of ways. Firstly, a portion of this material was treated with two ounces of a composition containing equal amounts of ascorbic acid, citric acid and sodium carbonate. The material was stored in the refrigerated condition at about 35° F. After about three days, the material showed clear signs of decay. Another portion of this material was treated with two ounces of sodium bisulfite only under the same conditions and

Composition A was 1/10 of an ounce each of ascorbic acid, citric acid and sodium bisulfite. The material thus treated showed clear signs of decay after five days' storage in the refrigerated condition at approximately 35° F.

Composition B represented 1/10 of an ounce each of ascorbic acid and sodium bisulfite. The treatment conditions were the same as above and the material showed clear signs of decay after three days' storage.

Composition D represented 1/10 of an ounce of sodium carbonate. The meat showed clear signs of decay after three days' storage.

Composition E represented 1/10 of an ounce each of sodium carbonate, ascorbic acid and citric acid. The material showed clear signs of decay after five days.

Composition F represented the composition of the present invention with 1/10 of an ounce each of sodium bisulfite, citric acid, ascorbic acid and sodium carbonate. The material showed no signs of decay after two weeks' storage.

EXAMPLE V

Example I was substantially repeated using potassium bisulfite, potassium carbonate, potassium citrate and potassium ascorbate. The same excellent results were obtained as in Example I.

EXAMPLE VI

In this example, eleven individual packages of beef were prepared, cut into approximately 1" cubes. The beef had previously been stored for a period of 7 days. Each cube was treated with one-tenth ounce of the composition of the present invention containing equal amounts of ascorbic acid, citric acid, sodium carbonate and sodium bisulfite. Daily an unopened package was removed, ground under sterile conditions with sterile phosphate buffer, serially diluted and tested for aerobic plate count and coliform count. All samples were held under refrigerated conditions at approximately 35° F. during the course of the study. In accordance with this study, a bacterial population of below 1,000,000 per milliliter is the generally recommended standard for beef. The results are shown in the following table.

TABLE I

Day	Color	Odor	Aerobic Count 35° F.	Coliform Contamination
1 - Initial Count	Good	Good	220,000	<1
2 - 24 hr. Count	Good	Good	240,000	9
3 - 48 hr. Count	Good	Good	240,000	4
4 - 72 hr. Count	Turning Brown	Good	260,000	4
5 - 96 hr. Count	Turning Brown	Good	290,000	<1
6 - 120 hr. Count	Turning Brown	Good	290,000	<1
7 - 144 hr. Count	Brownish Red	Good	12,000,000	<1
8 - 168 hr. Count	Brownish Red	Good	16,000,000	<1
9 - 192 hr. Count	Brownish Red	Good	20,000,000	<1
10 - 216 hr. Count	Brownish Red	Good	180,000	<1
11 - 240 hr. Count	Brownish Red	Good	600,000	<1

showed clear signs of decay after five days. A third sample was treated with two ounces of the composition of Example I as aforesaid. The material showed no signs of decay after two weeks of storage.

EXAMPLE IV

A variety of experiments were conducted with a variety of compositions on beef which had been previously stored to the point where the meat was starting to discolor.

The results of the study clearly showed that the preservative maintained the bacterial population well below the 1,000,000 count per milliliter generally recommended as a standard for beef for the first six days of the study. This was supported by organalytic testing. After five days the counts increased markedly to the tenth day. Coliform counts did not seem a factor. Spurious coliform counts on the second, third and fourth days were believed to have resulted from contamination during the packaging of the samples. On the tenth and eleventh days, the counts again dropped so that the

particular packages in question may have received more of the preservatives.

The foregoing data clearly shows that the composition of the present invention is capable of maintaining acceptable bacterial counts for at least six days and possibly longer even after the meat has been previously stored for an extended period of time when the meat is held at normal refrigeration temperatures.

EXAMPLE VII

Several compositions were formulated having the following bases:

Composition I.	Sodium Bisulfite Sodium Carbonate Ascorbic Acid	Equal Parts
Composition II.	Sodium Bisulfite Sodium Carbonate Citric Acid	Equal Parts
Composition III.	Sodium Bisulfite Sodium Carbonate Citric Acid Ascorbic Acid	Equal Parts
Composition IV.	Sodium Bisulfite Sodium Carbonate Citric Acid	85% 10% 5%
Composition V.	Sodium Bisulfite Sodium Carbonate Citric Acid Ascorbic Acid	85% 10% 24% 24%

A variety of experiments were conducted with beef. All experiments were conducted on the same piece of beef. The samples were cut into equal quantities and two ounces of each of the compositions were used to treat each portion of meat. All portions of meat were stored under identical refrigerated conditions and the condition of each portion evaluated daily for a period of sixteen days. The results are shown in the following table.

TABLE II

Color of Meat Treated With Formulas					
Day	I	II	III	IV	V
1	Good	Good	Good	Good	Good
2	Good	Good	Good	Good	Good
3	Good	Brown	Good	Good	Good
4	Brown	Dark Brown	Good	Good	Good
5	Dark Brown	Decayed	Good	Brown	Good
6	Decayed		Good	Dark Brown	Good
7			Good	Decayed	Brown
8			Good		Dark Brown
9			Good		Decayed
10			Good		
11			Good		
12			Good		
13			Good		
14			Good		
15			Good		
16			Good		

Sample III is the composition of the present invention. It can be seen that the meat treated with the composition of the present invention retained its good color characteristics for the full sixteen days of the test.

The meat treated with Sample I, sodium bisulfite, sodium carbonate and ascorbic acid only, retained its good color for only three days. On the fourth day it was

brown, the fifth day it was dark brown and on the sixth day it had decayed.

The meat treated with Formula II, the formula without ascorbic acid, retained its good color for only two days. The meat turned brown on the third day, on the fourth day it turned dark brown and on the fifth day it was decayed.

The meat treated with Formula IV retained its good color for four days. The meat turned brown on the fifth day, dark brown on the sixth day and had decayed on the seventh day.

The meat treated with Formula V retained its good color for six days. On the seventh day it turned brown, on the eighth day it turned dark brown and on the ninth day it had decayed.

EXAMPLE VIII

A three pound piece of fresh codfish and a three pound piece of fresh bluefish were cut into equal portions. A two pound portion of fresh scallops was divided into equal portions.

Thirty grams of the composition of Example I was thoroughly dissolved in one quart of water. One of the portions of codfish, one of the portions of bluefish and one of the portions of scallops were left untreated and one treated with a fine spray of the aqueous composition so that the treated materials were thoroughly wetted.

The treated and untreated materials were stored under ambient conditions. All untreated samples were spoiled in two days. All treated samples maintained their freshness for 25 days under the ambient conditions of storage.

This invention may be embodied in other forms or carried out in other ways without departing from the spirit or essential characteristics thereof. The present embodiment is therefore to be considered as in all respects illustrative and not restrictive, the scope of the invention being indicated by the appended claims, and all changes which come within the meaning and range of equivalency are intended to be embraced therein.

What is claimed is:

1. A composition for treating edible products to maintain the desirable color thereof and to maintain freshness consisting essentially of from 10 to 40% of each of the following components:

(a) a material selected from the group consisting of ascorbic acid, the sodium and potassium salts thereof and mixtures thereof;

(b) a material selected from the group consisting of citric acid, the sodium and potassium salts thereof and mixtures thereof;

(c) a material selected from the group consisting of sodium carbonate, potassium carbonate and mixtures thereof; and

(d) a material selected from the group consisting of sodium and potassium sulfite, bisulfite and metabisulfite and mixtures thereof.

2. A composition according to claim 1 wherein said components are present in substantially equal quantities.

3. A composition according to claim 1 wherein said components are ascorbic acid, citric acid, sodium carbonate and sodium bisulfite.

4. A composition according to claim 1 wherein said composition is dissolved in water.

* * * * *

Evidence
Appendix C

Dec. 9, 1952

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2,621,129

Filed Sept. 20, 1951

3 Sheets-Sheet 1

Fig. 1

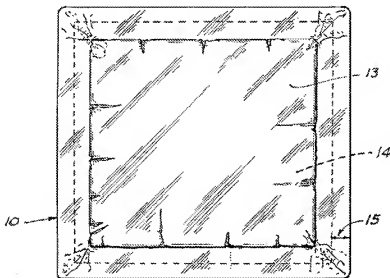
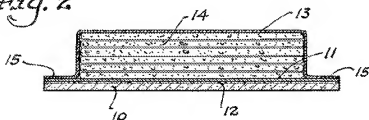


Fig. 2



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Filed Sept. 20, 1951

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Fig. 3

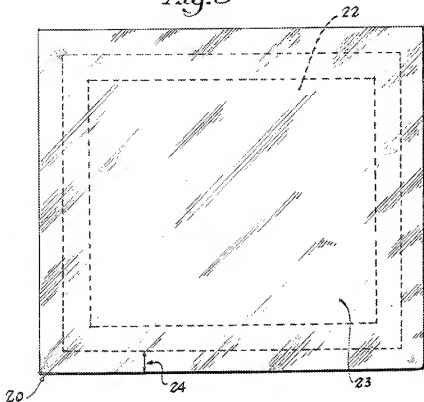
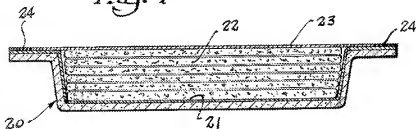


Fig. 4



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Filed Sept. 20, 1951

3 Sheets-Sheet 3

Fig. 5

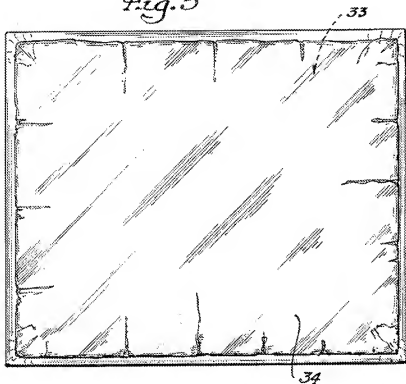
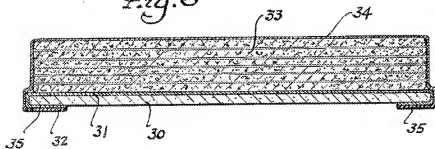


Fig. 6



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2,621,129

PACKAGING (VACUUM) MEAT ITEMS

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Application September 20, 1951, Serial No. 247,486

11 Claims. (Cl. 99—171)

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The present invention relates in general to gas-proof packaging food products and more particularly to a method of forming a gas-proof packaged food product and the package produced thereby.

In the food processing art many advances have been made in recent years in methods of vacuum and inert gas packaging of food products. The advantages of vacuum or inert gas packaging of foods, such as retention of color, flavor, and other properties, are common knowledge to those skilled in the art of food packaging. Because of the desirability of providing adequate visibility of the packaged food products, it has heretofore been common practice to utilize transparent films or laminates as vacuum packaging materials. One of the inherent disadvantages of such films or laminates, however, has been the flexibility of the peripheral film of the packages made therefrom and the consequent tendency of the side walls, corners and heat seals of such packages to fail due to the excessive stresses set up in the packages by flexing, deformation and the like in normal commercial handling. Failure of the package and subsequent introduction of air through pin holes, fractures, split seals or the like results in a loss of the advantages which accrue from vacuum or inert gas packaging.

It is therefore an object of the present invention to provide a method of gas-proof packaging which overcomes the disadvantages of the prior art.

It is a further object of this invention to provide a package which is relatively rigid, yet still permits adequate visibility of the enclosed product.

An additional object of the invention is to provide a package which is capable of retaining a vacuum or an inert gas atmosphere therein, and to be at the same time relatively rigid.

Additional objects not specifically set forth herein will be readily apparent to one skilled in the art from the following detailed description of the invention.

In the drawings:

Figure 1 represents a top view of one type of package embodying the present invention.

Figure 2 is a vertical sectional view of the package shown in Figure 1.

Figure 3 represents a plan view of a modified package embodying the present invention.

Figure 4 is a vertical sectional view of the package shown in Figure 3.

Figure 5 illustrates a plan view of a further modified package embodying the present invention.

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Figure 6 is a vertical sectional view of the package shown in Figure 5.

Generally the present invention contemplates providing a package having a gas-proof film secured to a relatively rigid backing member and a transparent, flexible, gas-proof wrapping material sealed directly to the gas-proof film secured to the backing member, and enclosing between it and said layer secured to the backing member the product to be packaged.

More specifically, in the package referred to in Figure 1 and 2 of the drawings, numeral ten (10) designates a relatively rigid backing member composed of paperboard, pressed fiber, plastic cardboard, or the like. Fixedly secured to the upper surface of backing member 10 is a thin film 11 of a gas-proof material forming the lower surface of the enclosure for the product. This film, which may be any of the gas-proof, film-forming materials such as saran (a vinylidene chloride polymer) and other thermoplastic resins, saran-coated cellophane, laminations of cellophane and Pliofilm or the like, may be applied to the member 10 as a film secured by the application of heat or by coating with a suitable layer of adhesive 12 or the like, or alternatively it may be applied in liquid form as by coating, spraying, dipping, etc., and allowed to harden into an adhesive coating on the surface of member 10. A transparent upper gas-proof film 13 which may be of the same type as the film 11 completes the enclosure for the product 14 and is disposed around the product 14 in such a manner as to contact substantially all the upper and the vertical or lateral surfaces of the product 14. This upper or cover film 13 is sealed around all four sides of the package to the backing film layer 11 as at 15, thus providing after vacuumizing an oxygen-free enclosure for the product 14. Obviously, if desired, an atmosphere of inert gas may be used in place of the vacuum in the conventional manner to provide a product sealed in the absence of oxygen.

Although the actual apparatus does not form part of the present invention, it is preferred to simultaneously seal all four sides of the package with a sealing bar which is a hollow die, shaped to the peripheral contour of the package while the film 13 is held in a tucked condition around the vertical or lateral surfaces of the product 14. Of course, the seals 15 along the four sides of the package may be made in any order while the film 13 is held in a tucked condition around the vertical or lateral surfaces of the product 14. For example, individual seals may be made on all four

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sides of the package, one seal at a time, or two sets of parallel seals might be effected one set at a time. Of necessity, the final closure or closures are made in the vacuum chamber.

In assembling the proposed package shown in Figures 1 and 2, it has been found that a tucking operation is essential to prevent bowing of the backing board where, as in these figures, the backing board does not conform substantially to the size and shape of the bottom and/or lateral surfaces of the product being packaged. In other words, in this package the dimensions of the cover film 13 should be sufficiently larger than those of the backing member under the product to allow the cover film to closely contact the lateral surfaces of the product 14 in addition to the exposed top surfaces. An auxiliary tucking device may be attached to the inner surface of the sealing bar die to hold the film 13 in contact with the lateral surfaces of the product 14 until the seal is effected.

A modification of the package of the present invention is illustrated in Figures 3 and 4 of the drawings. Referring to Figures 3 and 4, numeral twenty (20) designates a tray formed from paperboard or the like conforming generally to the size and shape of the product being packaged. Secured to the upper surface of tray 20 is a film member 21 composed of a gas-proof material. As discussed previously, this film may be applied by means of an adhesive or alternatively may be formed directly on the backing material by dipping or the like. The product 22 is then placed in the tray 20 upon the upper surface of the film 21. A cover film of gas-proof material 23 is then sealed as at 24 directly to the film 21 under a vacuum or with an atmosphere of inert gas.

In the modification of the package shown in Figures 3 and 4, tucking with the aid of an auxiliary device will generally be unnecessary as the backing board itself is shaped to allow for the height dimension of the product and will generally conform to the lateral surfaces of the product being packaged. In this modification the protruding lips or edges of the tray are the surfaces on which the seals are made.

Figures 5 and 6 of the drawings show a further modification of the package. In some instances it may be desirable to extend the layer of gas-proof material applied to the backing member to more than one surface of the backing member. Of course, if the gas-proof material is applied in liquid form, as by dipping the member into a solution of the gas-proof material, the backing member would be equally coated on all sides. In the modification illustrated in Figures 5 and 6, the backing member 30 has fixedly secured thereto, in any of the ways heretofore disclosed, a layer of gas-proof material 31. In this instance, the gas-proof layer should extend over at least a portion of the lower surface of member 30 as shown at 32 as well as over the entire upper surface thereof 31. The product 33 is completely enclosed by the cover film 34 which is sealed directly to the gas-proof laminate as at 35.

A further modification of the method of forming the improved gas-proof package described herein comprises enclosing the product between upper and lower films of sealable, gas-proof film material and vacuumizing in any of the conventional ways familiar to those skilled in the art and then securing substantially the entire lower surface of the enclosure, including the sealed edges or lines of closure thereof, to a relatively

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rigid backing member which may or may not be coated with a film of sealable, gas-imperious material. The lower surface of the above vacuumized enclosure may be secured to the rigid backing member by applying heat to at least one of the surfaces as in heat sealing, or by applying a thin coat of glue or adhesive to one of the contacted surfaces and bringing these surfaces together to provide a relatively rigid gas-proof package as described heretofore.

A package formed according to the present invention, namely, of a rigid backing material having secured to substantially the entire upper surface thereof a gas-proof film forming the lower enclosure surface to which a cover film of gas-proof material is sealed, provides the advantage of adequate visibility of the product along with greatly improved stability resulting from the use of a rigid backing member having the entire lower enclosure surface secured thereto. Such a package eliminates the possibility of fractures in the film due to flexing of the package or dimensional stresses set up in the film itself. Furthermore, the seals in the improved package of the present invention, being associated directly with the rigid backing material, are themselves relatively rigid and therefore much less likely to fail due to flexing of the package.

For example, in laboratory tests made to simulate actual shipping conditions, the vacuum package shown in Figures 1 and 2, when made from 400 gauge saran laminate and 14 point solid sulphite paperboard and covered with 200 gauge saran, will withstand an average of twenty-five times more vibration without producing leaking packages than will a vacuum package of two sheets of 200 gauge saran film only. The packages were vibrated by placing them with 1½ inch clearance in the compartment of a Precision Scientific Company shaking machine which operated at 225 cycles per minute with a 1½ inch stroke. The tests were carried out at 40° F.

In a second test a vacuum package consisting of a laminated film of No. 300 cellophane and 120 gauge Pliofilm glued to a 20-point solid sulphite paperboard with the same cellophane-Pliofilm laminate as the cover film was compared with a vacuum package made of two sheets of the cellophane-Pliofilm laminate by vibrating in the same apparatus and at the same rate as in the previous test. The vacuum in the paperboard-supported packages was retained three times longer under the conditions simulating actual shipping conditions than was the vacuum in the non-supported packages.

As pointed out above, any sealable, gas-proof, film-forming material may be used to provide the lamination with the relatively rigid backing member. However, since the invention is directed primarily to packaging of food products and the like, it is preferred that the film-forming material be non-toxic and of such a nature as not to impart undesirable odors or tastes to the enclosed product. A suitable type of gas-proof material is transparent film having an O₂ transmission rate of about 0.6 cu. cm., per 100 sq. inches, per 24 hours, per mil thickness, at 77° F. and 760 mm. Hg. Since the relatively rigid backing material is usually opaque in nature, there is no necessity for the laminated gas-proof film laminated to its surface to be transparent. Therefore, if desired this film may be opaque in nature and suitably colored to provide an attrac-

tive background for the packaged product. The gas-proof film which is secured to, laminated to, or coated on the tacking material should, however, be sealable. The cover film which is secured to the laminated, gas-proof film to form a completed package is preferably transparent and may be composed of any suitable sealable, gas-proof, film material known in the art. In order to prevent bowing of the relatively rigid backing member when the package is formed by employing a backing member which does not conform to the shape of the product being packaged and then sealed under vacuum, the cover film should have a substantially greater surface area than the area of the backing member underneath the product. In other words, the dimensions of the cover film should be sufficiently larger than those of the backing member to permit tucking as described heretofore.

In forming the seals between the laminated gas-proof film and the gas-proof covering material, it has been found that either heat, electric impulse, or electronic sealing provides effective and satisfactory seals. One of the important features of the invention is the ability to seal directly to the relatively rigid backing member and retain a completely gas-proof package by so doing.

Although the package of the present invention has been illustrated only with respect to a flat backing member and a tray-shaped backing member, it is obvious that the invention may be applied to any shape of package as, for example, a carton or the like.

It should further be understood that the present invention is not restricted to packaging any particular food product or a food product having a particular form. Also, the food product within the package may be arranged in any desired manner. For example, when a sliced product is being packaged, the slices may be superimposed one directly over the other, or the slices may be arranged in a single thickness or in slightly overlapping arrangement.

Obviously, many modifications and variations of the invention as hereinbefore set forth may be made without departing from the spirit and scope thereof, and therefore only such limitations should be imposed as are indicated in the appended claims.

We claim:

1. A method of forming a gas-proof package for food products which comprises: fixedly applying a layer of gas-proof material to at least one surface of a relatively rigid backing member said layer being in contact with said backing member over at least one entire surface thereof; placing the product to be packaged on said gas-proof layer immediately above said backing member; placing a gas-proof cover material over said product; and thereafter sealing said gas-proof cover material directly to the gas-proof layer on said backing member.

2. A method of forming a gas-proof package for food products which comprises providing a rigid supporting surface by: fixedly applying a layer of gas-proof material to at least one surface of a relatively rigid backing member; placing the product to be packaged on said gas-proof layer immediately above said backing member with at least one entire surface of which said gas-proof layer is in contact; placing a gas-proof cover material over said product; and thereafter sealing said gas-proof cover material

in the absence of oxygen, directly to the gas-proof layer on said backing member.

3. A method of forming a gas-proof package for food products which comprises: fixedly applying a layer of gas-proof material to at least one surface of a relatively rigid backing member, said gas-proof material being in contact with said backing member over at least one entire surface thereof; placing the product to be packaged on said gas-proof layer; placing a gas-proof cover material over said product; tucking said gas-proof cover material along the lateral surfaces of the product; and thereafter sealing said gas-proof cover material directly to the gas-proof layer on said backing member.

4. A method of forming a gas-proof package for food products which comprises: fixedly applying a layer of gas-proof material to at least one surface of a relatively rigid backing member, said gas-proof material being in contact with said backing member over at least one entire surface thereof; placing the product to be packaged on said gas-proof layer; placing a gas-proof cover material over said product; tucking said gas-proof cover material along the lateral surfaces of the product; and thereafter sealing said gas-proof cover material, in the absence of oxygen, directly to the gas-proof layer on said backing member.

5. In a method of forming a gas-proof package for food products, wherein a food product is completely enclosed within upper and lower films of gas-proof material, the step comprising fixedly securing substantially the entire outer surface of the lower of said gas-proof films to a relatively rigid backing member, said backing member having at least the overall dimensions of the lower portion of said food product, said lower gas-proof film being in contact with at least one surface of said backing member over at least the area covered by the lower portion of said food product.

6. A gas-proof package which comprises in combination with a food product: a relatively rigid backing material; a layer of gas-proof material fixedly secured to said backing material and in contact with at least one entire surface thereof, said layer of gas-proof material providing a laminated support with said backing material for said food product; a food product disposed on said laminated support; and a second layer of gas-proof material in contact with substantially all of the top and lateral surfaces of said product, said second layer being sealed directly to said first layer to completely enclose said product therebetween.

7. A gas-proof package which comprises in combination with a food product: a relatively rigid backing material having at least the overall dimensions of the lower portion of said food product; a layer of gas-proof material fixedly secured to said backing material and in contact with at least one surface thereof over at least the area covered by the lower portion of said food product; a food product disposed on said layer of gas-proof material; and a second layer of gas-proof material sealed directly to said first-mentioned layer, said second layer completely enclosing between it and said first-mentioned layer said food product.

8. A gas-proof package which comprises in combination with a food product: a relatively rigid backing material; a layer of gas-proof material fixedly secured to at least one side of said backing material and in contact with at least one entire surface thereof; a food product dis-

posed on said layer of gas-proof material; and a second layer of gas-proof material sealed directly to said first-mentioned layer, said second layer completely enclosing between it and said first-mentioned layer said food product.

9. A gas-proof package which comprises in combination with a food product: a relatively rigid backing material having substantially the same configuration as the lower portion of said food product; a layer of gas-proof material fixedly secured to said backing material and in contact with at least one surface thereof over at least the area covered by the lower portion of said food product; a food product disposed on said layer of gas-proof material; and a second layer of gas-proof material sealed directly to said first-mentioned layer completely enclosing between it and said first-mentioned layer said food product.

10. A package as in claim 9 wherein said relatively rigid backing material is in the form of a tray.

11. A gas-proof package which comprises in combination with a food product: a relatively rigid backing material; a layer of gas-proof material fixedly secured to the surface of said backing material and in contact with substantially the entire surface thereof; a food product disposed on said layer of gas-proof material; and a second layer of gas-proof material in contact

with substantially all of the top and lateral surfaces of said product; said second layer being sealed directly to said first layer to completely enclose said product therebetween.

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